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ANALOG DEVICES DSP KIT OFFER — see page 31

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JUNE 1998

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with PROFESSIONAL ELECTRONICS & ETI

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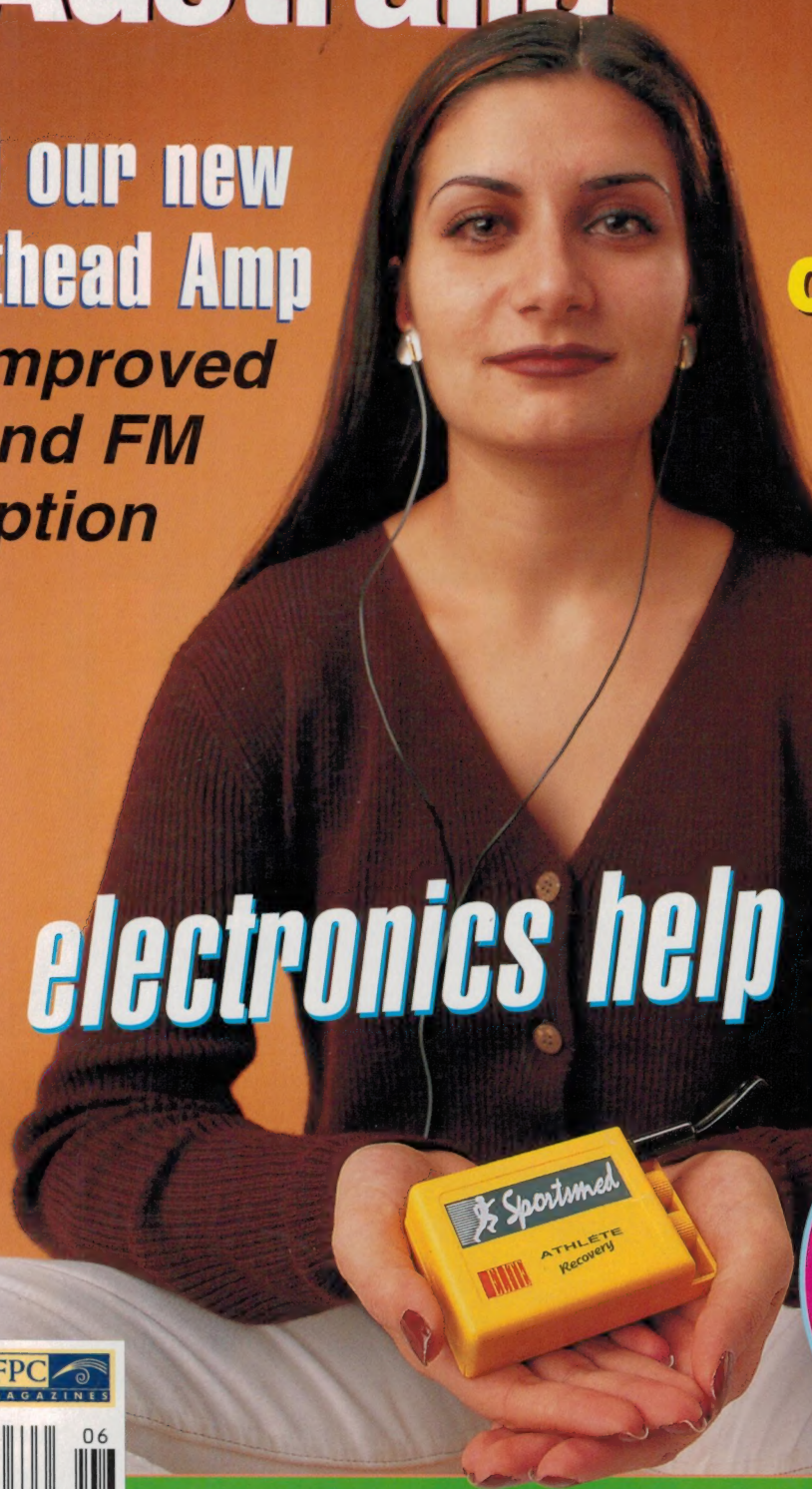
for improved TV and FM reception

Sony's new camcorders: Epilog for analog?



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with PROFESSIONAL ELECTRONICS & ETI

June 1998 Volume 60, No. 6

Sony's new camcorders

14 *Sony's new range of 8mm and Hi8 analog camcorders offer really impressive image quality.*

Thinner and thinner...

6 *Can laptops get much thinner? NEC's latest is a mere 32mm thick.*

Local firm's breakthrough

74 *Innovative Technologies Group's new DVT system is possibly the most advanced in the world...*

World of Electronics

Projects and Technical

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On the cover

FPC advertising co-ordinator Magdaline Youssef kindly volunteered to try Bio Electronics' Sportsmed TNS and CES device, which is used with ear-lobe electrodes to alleviate stress, tension and anxiety. See our discussion of these devices in Forum, starting on page 28.

(Photo by Phil Aynsley)

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Letters to the Editor

Analog cellphones

In response to your Forum article on double adaptors and the wiring of AC mains plugs, I find it rather curious why we have a convention at all on how to wire an AC plug (well, I do think there should be a definite place for the earth wire!).

Are the Europeans and Americans a bit more enlightened? There you can insert an AC power plug either way and surely that is the safest way. If you can't rely on a plug (or socket) being wired correctly, why create a false sense of security. As one of your correspondents pointed out, one should always treat BOTH wires in an AC mains connected as live unless proven otherwise.

If I may comment on another subject: the imminent shutdown of the Analog Mobile Phone Network. This does not seem to create much interest in your publication, even though it may affect thousands of people in country as well as city areas.

There does not seem to be any reasonable argument for doing so in a country as vast as Australia. The digital system, while more advanced in some ways, does not seem very suitable for the wide open spaces we have and it would probably be far too expensive to provide the same coverage as now exists with the analog network. In fact it would probably take as many as 10 times the number of towers now in use — what a lovely thought!

Telstra and the other carriers are always very quick to point out flaws in the analog network, and their slick marketing quickly espouses the advantages of digital, i.e. roaming in x-number of countries (some you may never have heard of!). They don't tell you that you need an analog phone to roam in the USA and Canada, as well as Japan... Surely these places are visited by more Australians than Lithuania and Leichenstein.

And, in a recent study of the relationship between brain tumours and RF exposure done in WA, somehow that publicity machine snuck in and pointed out that if there is a relationship, it must have been caused by analog phones since digitals have not been used as much during the period in question! How about that for scientific evidence! They don't shout about the fact that you should not use a digital phone if you have a heart pacemaker though!

A number of my acquaintances who have recently purchased digital phones have been quite surprised at how unreliable digital phone coverage is compared to analog, and that includes many areas in the city where digital coverage is supposed to be at least equivalent to analog. When travelling between Sydney and Brisbane the difference between digital and analog coverage is unbelievable!

Horst Leykam, Dee Why NSW.

Filter danger

A friend brought around a computer (Sprinter brand) and asked me to have a look at it. He said he went to turn it on and was greeted by a loud bang and flash from the back of the machine.

I took the PSU out of the case, removed the covers, and was surprised to see blackening around the input filter assembly for the mains feed to the rectifier. This is a standard configuration for this type of PSU and in this case it consisted of a powdered iron core toroidal with the mains active and neutral feed wires normally coiled on opposite halves of the toroidal and suitably insulated. On closer inspection the mains wires were fed to the toroidal using enamel coated copper wire which was twisted together and *coiled together* around the toroidal. It was no wonder it went 'Bang'! To say the least, I was amazed at this basic disregard for wiring safety. I shudder to think how many other units are floating around with this sort of configuration.

I have also noticed a lot of these PSU's with absolutely no filtering, no MOVs and borderline rated diodes and other components. Obviously this is done to cut costs, but raises the question of how long these products will survive in operation, and the effect of lack of filtering on the rest of the machine and other devices hooked up to it on the same or nearby circuits.

I now inspect the devices I buy and check safety, add filters and better rated components if I feel it is needed. Have you had concerns raised by others?

Dave Kelly, Iveragh Qld.

Digital cameras

It seems that Ray Chapman, (Letters to the Editor Jan 98) has missed the purpose of our fine magazine here. He bemoans the use of digital cameras for the publication and waxes lyrical at the superb photography of a public school photograph. If this were a photographic magazine extolling the virtues of print, then I could understand his criticism; but it is unlikely that we would ever want to see the pupil (pun intended) colour and detail of a school assembly here in Electronics Australia.

This is a magazine about developments in electronics, including the electronics of modern day film cameras and not about the development (another pun) in film.

The only way we can judge for ourselves the massive improvement of digital photography equipment is for the publication to show us as accurately as possible these gains in print. Now I accept that there is still a long way to go to achieve the standards obtained by film, but it *will* happen Ray, and it will happen much quicker than the progress from Box Brownie to the present day.

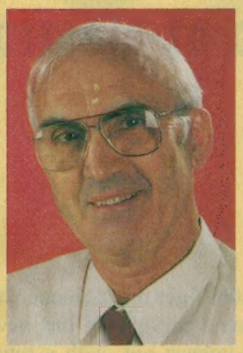
A journalist insisted that we should resist change at all cost, when I enquired about him not using digital technology for his newspaper the other day. He was quick to inform that the resolution is not as good as film (sound familiar?). I pointed out that digital resolution is already superior to that used in newsprint and with the advantages already at hand, film is obsolete already in this field.

I'm sure this magazine will use the highest quality media available when it is desirable and they are doing their readers many favours to that end. Ray's final sentence sums up perfectly. 'I thought that technology was supposed to improve the standard, not reduce it'. That's exactly what it's doing Ray, and it won't matter how many fingers are pushed into holes in the dyke, you will not stem the flood of progress.

Bob Graffham, Sanctuary Point NSW. ◆

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

Editorial Viewpoint



Where ARE all of our new service techs?

At various times in the last few years, we've discussed in our Forum column the many problems faced by Australia's electronics servicing industry: the greater complexity, yet higher reliability and ever-lower replacement cost of modern equipment; the frequent difficulties in obtaining replacement parts and service manuals (and their relatively high cost); the scaling-back of service departments by many organisations, in an effort to boost profitability; the reduced committment towards electronics trade apprenticeships and technician training in many states; and of course the unwillingness of many firms to offer pay rates higher than the extremely modest 'award' figures, which seem quite inadequate considering the training and technical expertise required by a good service technician. There are a *lot* of problems, and as yet little sign that anyone in either our Federal or State governments is prepared to do anything much towards solving them. One can only sympathise with those in the industry who've become frustrated and demoralised...

I must confess that I myself hadn't realised just *how* serious the situation had become, until I received a phone call the other day. It was from Mr Tony Carter, who runs a servicing and manufacturing firm on the Gold Coast.

Did you notice the small advertisement on page 37 of our April issue, in the Serviceman column — the one offering $1000 per week for an expert TV servicing technician? Well, that was Mr Carter, and he tells me that he ran virtually the same ad in most of the major newspapers around the country. He's really desperate to find good, experienced servicing technicians, he told me.

Now for the punchline. Can you guess what response he received? Nothing. Not a single reply or enquiry!

Understandably Mr Carter is perplexed, frustrated and disappointed. Aren't there any experienced technicians left, he asked me? None prepared to even consider relocating to the thriving Gold Coast area, for roughly double the award rates of pay? It seems not. Either that, or people were perhaps suspicious about what seemed like an unrealistic rate of pay. (Perhaps he'd have had more success offering *less* money, but with an offer to pay relocation expenses; I don't know.)

One of the points Mr Carter made was that service technician training courses and trade apprenticeships seem to have almost dried up — at least in his area. Apparently the nearest apprenticeship is available only in Brisbane (100km away), despite the fact that the greater Gold Coast area has a population probably rivalling that of Melbourne.

When I checked with our own Serviceman, who has had a lot to do with both TETIA and service technician training, he seemed to confirm that (a) domestic service techs are indeed now a dying breed, with very few young people being attracted into the industry, and the remaining experienced techs in very high demand; and (b) the nation's training schemes do seem to have almost entirely fallen in a hole...

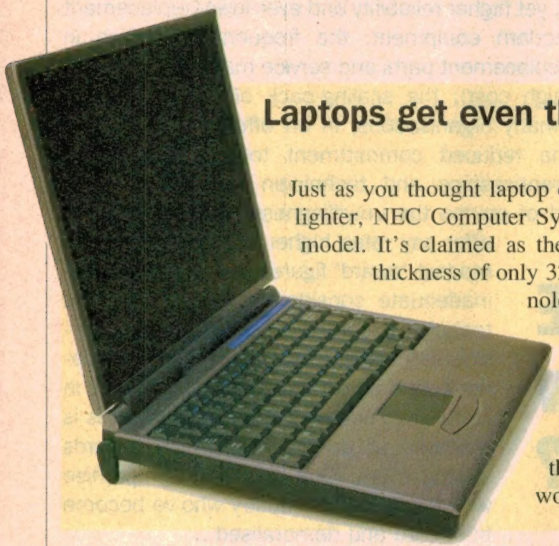
So it looks like Mr Carter, who says he could employ a number of good technicians at the pay rates concerned, might well be out of luck. It doesn't augur at all well for the future of Australia's electronics servicing or manufacturing industries, does it?

Jim Rowe

PS: If you're one of the few experienced service technicians left, and would like to ring Tony Carter to discuss his offer, the phone number he gave me is (07) 5529 6109.

WHAT'S new

in the ever-changing world of electronics



Laptops get even thinner

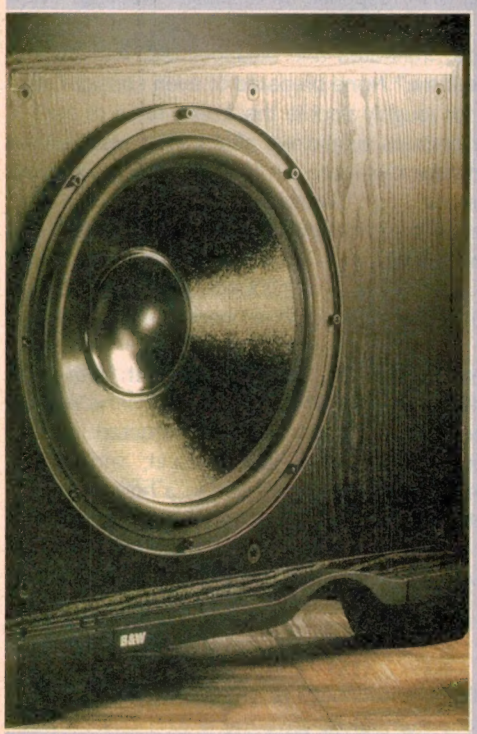
Just as you thought laptop computers couldn't get much thinner or lighter, NEC Computer Systems has given a preview of this new model. It's claimed as the thinnest and lightest yet, with a total thickness of only 32mm. Thanks to new LCD display technology, the screen can display 16.7 million colours but is only 6.4mm thick.

The new model isn't just thinner and lighter, either — it's one of the first to use Intel's new low-consumption 266MHz Pentium II processor, so it's the equivalent of many high performance workstations. (Business Wire)

New B&W active subwoofers

Well known UK loudspeaker manufacturer B&W has released a new ASW range of active subwoofers, developed specifically to exceed the demands of new surround sound formats such as Dolby Digital (AC-3) and DTS.

According to Geoff Matthews, General Manager of local B&W distributor Convoy International, "An exciting new development on all three new ASW models is the Flow Port down-firing bass port system. The large port flare and sculptured surface, mounted on the underside of the unit, is precisely dimpled with tiny pits in the same fashion as the surface of a golf ball. Indeed, the complex laws of aerodynamics that make a golf ball slice thorough the air and travel further distances have been applied to these new ASW subwoofers."



"B&W engineers have researched the flow patterns of air exiting and entering a port, and by using Computational Fluid Dynamics (CFD) software, the surface has been optimised by adding thousands of pits which ensure the air flows freely down the tube and follows the curvature of the flared port. This in turn results in greater and far cleaner bass output with no unwanted resonances and chuffing. Furthermore, far higher sound pressure levels can be attained without any loss of details", adds Matthews.

The new ASW Series subwoofers are priced at $1595 (ASW1000), $2495 (ASW2000) and $3500 (ASW3000).

For more information circle **151** on the reader service card or contact Convoy International, Unit 7, Discovery Cove, 1801 Botany Road, Botany 2019.

'Best car audio unit'

Blaupunkt's New York CD was named Head-Unit of the Year in the Car Audio Equipment class at the Sound & Image Industry Awards, held in Sydney late last year. The award came less than 12 months after the re-establishment of Blaupunkt in-car entertainment systems onto the Australian market, acknowledging the brand's strength, advanced design and technology.

In its assessment, the judging panel commented that the Blaupunkt New York CD was notable for its "brilliant performance in all areas, supported by excellent ergonomics and on-the-road useability."

A division of the Robert Bosch global organisation, Blaupunkt claims its success is based creating products which are developed with technological and aesthetic advancement in mind, to complement modern vehicles.

The New York CD matches a top-of-the-range performance with an uncomplicated menu-controlled operating system. Leading edge sound technology adapts the unit's sound output to the acoustic demands of the car interior and automatically varies the output to mask road noise so that studio quality sound is provided at all times. Individual sound preferences can be set with the digital four-channel, nine band equaliser.

For more information circle **148** on the reader service card or contact the Blaupunkt Customer Service Hotline on 1800 629 414.

It's a Game Boy — and a camera too!

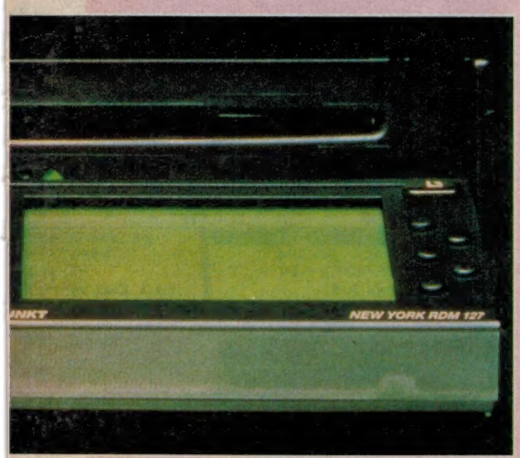
Nintendo has released a new twist on its extremely successful Game Boy portable video game system — a camera cartridge, featuring a swivelling big-eye lens, which turns the Game Boy into a low cost, easy to use digital still camera. A separate Game Boy Printer is used to print out photo stickers, for kids to collect and trade.

The camera can take and store up to 30 images, and allows the shots to be arranged and viewed as an animated short. Following its release in Japan in February, it sold nearly 500,000 units in the first three weeks. Suggested retail prices in the USA are $49.95 for the camera cartridge and $59.95 for the printer. (Business Wire)

New Proceed amp delivers five times 125W

US manufacturer Madrigal Audio Laboratories, which markets the Mark Levinson, Proceed, Citation and Audioaccess brands, has introduced the first Proceed five-channel amplifier. And although the ability to deliver full rated power with all channels driven at once is virtually unknown in multi-channel amps, the Proceed AMP 5 is rated at 125W/ch into 8Ω, from 20Hz to 20kHz, with all channels driven simultaneously and continuously. It also 'doubles down' to 250W/ch at 4Ω, using the same criteria.

The amplifier can deliver this impressive performance thanks to an unusual power supply design. Rather than using a single power supply from which all channels must draw, it uses three massive toroidal transformers with a total capacity of over 2000VA, to feed five separate power supplies. Madrigal says it's as close to a 'quintuple-mono' design as can be fitted into a reasonably compact, rack-mountable chassis. Not surprisingly the result weighs in at 50 kilos...

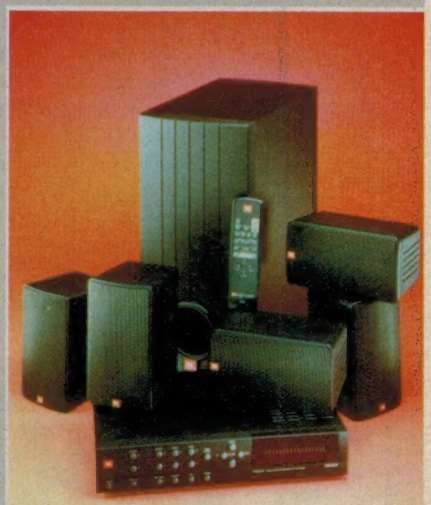


The output stages use eight 125W output transistors per channel and deliver ample current even into low impedance loudspeakers. Comprehensive protection circuitry and Madrigal build quality ensure a long and reliable lifetime of operation.

The Madrigal AMP 5 carries a US suggested retail price of $4995. For more information circle **144** on the reader service card or contact Madrigal at 2081 South Main Street, Middletown CT 06457.07081, USA.

Complete home theatre system from JBL

JBL's new Simply Cinema range are claimed to provide complete home theatre system solutions. The range currently includes three systems, the ESC200, ESC300 and ESC550, each of which comes complete with electronics.



Top of the range is the ESC550, which was engineered to deliver JBL's high performance Signature Sound without requiring bulky speakers or complex electronics. It's fully equipped to deliver Dolby ProLogic when used with surround encoded sources. At the heart of the ESC55O is The Source, a novel control centre with built-in AM/FM Stereo tuner and a single disc CD player. Along with the control centre come three two-way front speakers, two satellite surround speakers, a powered subwoofer that includes the amplifier for all the front and surround speakers, and a credit card-sized remote control. The ESC550 even includes the speaker wire required to install the system.

Since the system's audio power amplifiers are hidden out of sight in the subwoofer cabinet, the control unit is able to take on a unique wedge shaped design that is equally at home on a coffee table, on a shelf or even mounted on an office wall. A large display and intuitive controls make set-up and operation quick and easy. RRP for the ESC550 is $3995.

For more information circle **147** on the reader service card or contact Convoy International, Unit 7, Discovery Cove, 1801 Botany Road, Botany 2019.

WHAT'S new in the ever-changing world of electronics

Car audio systems offer power, security

Pioneer's new DEH-P646 and DEH-P545R four-channel CD player/receivers for cars offer the latest and best in security features, as well as superior performance. Both models are equipped with DFS Alarm (Detachable Face Security), which allows you to use the faceplate to arm and disarm the siren alarm as you remove it and slip it into its handy carrying case.

When activated by your car door sensor, the alarm sounds through the car's speakers and the unit's LED stops flashing, so you can see at a glance if your car has been broken into. The DEH-P646 goes even further with DFS Alarm+ by letting you connect up external sirens, remote control, and sensors such as glass break and ultrasonic.

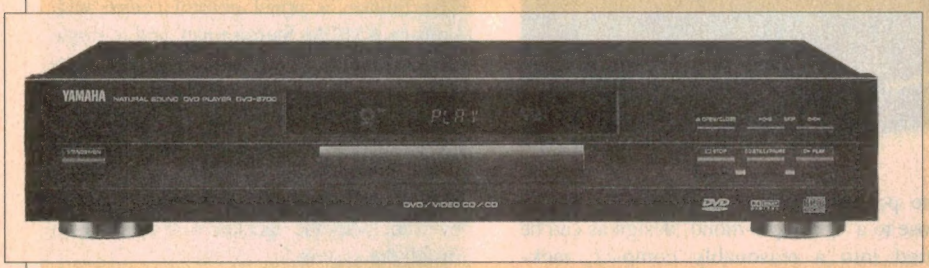
Performance of the DEH-P646 and DEH-P545R is enhanced via the use of a single-bit DA converter with 8x oversampling and an 8fs digital filter. The proven S-7 mechanism and three-beam laser pickup assures excellent CD sound quality.

Both units feature Pioneer's built-in 40W x 4 power amplifier, plus additional features like Bass Boost, electronic control of volume/balance and bass/treble, Source Tone Control, and Source Level Adjustment. They also offer Pioneer's Front Image Enhancer (FIE), which uses a low-pass filter to recreate the dimensional ambience you might hear listening to live music on stage.

The DEH-P646 and DEH-P545R carry an RRP of $699 and $629 respectively and are available at Pioneer dealers throughout Australia. For more information circle **145** on the reader service card or contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195.

Second generation DVD player from Yamaha

Yamaha has introduced its second generation DVD player, the DVD-S700, featuring both Dolby Digital and MPEG (Moving Pictures Expert Group) audio decoding to address Pacific and European software considerations.



"The DVD-S700 completes the range for Yamaha in providing an audio-video package for consumers who pursue home theatre excellence," said Phil Hawkins, Marketing Manager of Consumer Electronics Division, Yamaha Music Australia. "However, because of its potential in multimedia applications beyond movie entertainment, it will eventually be the ultimate replacement for CD, CD-ROM, VCR and Laserdisc."

The DVD-S700 is compatible with Video CD, conventional audio CD, standard DVD Video and Dolby Digital sound. It incorporates a high quality Dolby Digital decoder which can provide a two-channel or five-channel Dolby Digital analog output. The player also provides an optical audio output, as well as a coaxial digital audio output.

A 38-key remote control provides an on-screen menu display with GUI (Graphical User Interface) for easy setup. RRP is $1699.

For more info circle **140** on the reader service card or contact Yamaha Music Australia, 17-33 Market Street, South Melbourne 3205.

Portable CD player has 20-second memory

Kenwood's new DPC-885 portable CD player is designed with the sports person in mind, with the 'muscle' to stay on

Top of the line home theatre amp

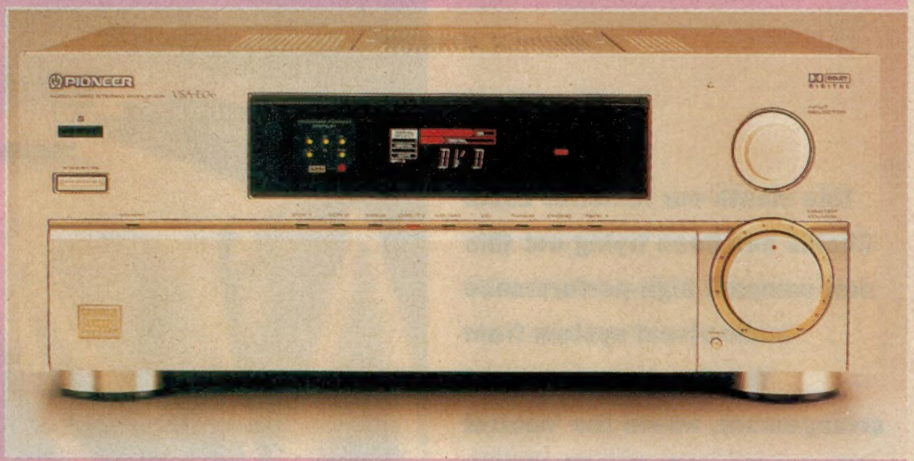
Pioneer's new VSA-E06 audio/video amplifier has become the flagship of its Home Theatre component stable, and is described as 'reeking opulence', from its champagne gold exterior to its hydraulically operated flip-down front panel. It also incorporates the most advanced version of Lucasfilm's Home THX — THX 5.1 — said to ensure that you will experience movie soundtracks just the way the film maker intended, from poignant whisper to nerveshattering explosion.

At the heart of the VSA-E06 are the Dolby Digital and Dolby Pro Logic Surround features. The VSA-E06 provides full Dolby Digital (AC-3) decoding, and comes with a preamp output for an optional powered subwoofer. For optimum sound realisation it produces an impressive 100 watts RMS to each of its five main channels. To achieve this power rating Pioneer engineers have incorporated Hex MOSFET power output devices, claimed to maintain better linearity and dissipate less heat than conventional bipolar transistors or MOSFETs.

The VSA-E06 also boasts extensive Digital Signal Processing (DSP) features to further enhance the home theatre experience. This is achieved by processing the Dolby Digital signals in digital form; controlling the steering logic of Dolby Pro Logic Surround for precise localisation; and controlling sound field by creating reverberation and reflections.

Operation is simplified by an on-screen GUI (graphical user interface), which turns your TV into an interactive display to guide you through operations and lets you easily adjust and confirm settings.

The VSA-E06 has an RRP of $2499 and is available at selected Pioneer dealers throughout Australia. For more information circle **142** on the reader service card or contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195.



track no matter what the impact of your workout. The built-in Digital Anti-Shock Circuit (DASC) uses a 20-second digital recovery memory (8MB of DRAM) and wide capture circuit to make sure that a little rough treatment won't interrupt your musical enjoyment.

A 'digital damper' speeds up recovery after laser pickup mistracking or vibrations, while the sturdy sports-type headphones are claimed to remain comfortably in place even while jogging or doing aerobics. Power comes from two AA alkaline batteries, which provide up to 17.5 hours of playback.

The DPC-885 has an RRP of $379. For more information circle **146** on the reader service card or contact Kenwood Electronics Australia.

New JBL monitors offer 'absolute accuracy'

JBL says its new LSR32 three-way mid-field monitor loudspeakers offer audio professionals something they've always wanted: an absolutely accurate audio reference monitor that provides consistent, precise sound reproduction in a wider field than ever before, regardless of the playback environment.

The company says its LSR32s combine JBL's latest transducer and system technology with recent breakthroughs in psychoacoustic research. LSR, or Linear Spatial Reference, is based on a set of design goals that carefully control the overall performance of the system in a variety of acoustic spaces. Instead of focusing on a simple measure such as on-axis frequency response, LSR designs require much better control over sound dispersion via transducer selection and crossover frequency design. Critical decisions of image placement, EQ, balance and timbre are typically made within +/-15° vertically and +/-30° horizontally: the area where engineer, producer and artist make critical mixing decisions, and the area that LSR is optimised for superb in-room response.

The LSR32 incorporates the same Dual Coil Drive technology first introduced in JBL's HLA Series Tour Sound System (a revolution in itself!), which delivers virtually distortion-free sound at higher power levels than ever before — distortion is an incredibly low 0.1% throughout the critical upper two decades for completely fatigue-free operation. Power compression is less than 1dB for stable spectral balance, regardless of playback level.

For more information circle **150** on the reader service card or contact Jands Electronics, 40 Kent Road, Mascot 2020.

Yamaha's AV-1 compact home cinema system

This month our reviewer Louis Challis has been trying out this new compact high-performance audio-visual system from Yamaha. It uses a novel arrangement, where the 'control unit' contains only the CD player, AM/FM Stereo radio tuners and controls. The amplifiers and power supplies are all housed out of sight in the subwoofer box, and the compact visible speakers mount unobtrusively on your walls...

If you live in a city apartment, then you are well aware of just how tight space can be. There is seldom enough room to install what you already own, without adding bulky items of high fidelity equipment to further enhance the quality of that environment.

Nowhere is that problem more obvious than in the average minuscule Japanese apartment. The apartments which I have been fortunate enough to visit are remarkably small. They exhibit spatial problems which outrank our own perceived problems by a very wide margin.

Yamaha Corporation were one of the early Japanese manufacturers who addressed this problem, with their YST 99CD — developed almost a decade ago. The primary attribute of this system was its delightfully small dimensions, into which they shoe-horned a CD player, tuner and twin amplifiers.

Other manufacturers, especially the Bose Corporation, followed the lead and to their credit introduced further improvements.

At first sight, home cinema systems and minuscule apartments appear to be incompatible. A good Dolby Pro-Logic system has five conventional sound channels, which are frequently supplemented by a subwoofer. The thought of placing five (or six) loudspeakers in a room, together with the amplifier/control system, is daunting to say the least.

Yamaha's R&D section have addressed this problem head-on and developed an innovative and exciting system, which they have called their AV-1. Its major attributes are that with the exception of the SW-AV1 subwoofer, which can be hidden anywhere in the room (on the floor) and the TCD-AV1 controller which can sit anywhere on a shelf, table or another item of furniture, the other five speakers (two front, centre and two rear) are designed to be attached to the wall. As a consequence, those speakers do not intrude into your valuable living room or bedroom space.

Unusual approach

Yamaha's design team have adopted a somewhat unusual approach with the system's functional design. The TCD-AV1 controller incorporates neither amplifiers nor power

supplies. Its contents are restricted to an excellent CD player, an AM/Stereo FM tuner, a digital alarm clock and timer. The front panel incorporates large and easily accessed panel switches (some of which provide toggle action), supplemented by a large display and the CD access tray.

The rear panel provides multiple sockets for a more than adequate range of optional inputs from other items of equipment, plus video outputs and audio signal outputs via multi-pin miniature DIN sockets, and conventional colour coded and clearly annotated RCA sockets.

Whilst the TCD-AV1 control unit's front panel provides the vast bulk of the control functions you may require, it's supplemented by a comparatively small remote control unit which expands your flexibility and mobility, when you wish to remain seated in your armchair or lie in bed.

The system's six amplifiers (5 x 30 watt and 1 x 50W) and power supplies are neatly packaged in a well ventilated enclosure on the back of the subwoofer. All the wiring and hardware needed to interconnect the system are supplied — right down to the speakers' wall mounting brackets.

The interconnections between the controller and the subwoofer are neatly encompassed by two long cables, one being a miniature multicore DIN cable, whilst the other is a conventional two core coaxial cable with more than adequate length for a small apartment.

Test results

The TCD-AV1 controller itself is neat with a brushed satin aluminium finish with large switches and sensibly sized display on its front panel. Its CD player is well designed and provides a smooth and outstanding frequency response. Its output lies within +/-1dB from 8Hz to 20kHz (see graph).

I briefly evaluated the CD player's most critical performance characteristics and discovered that it provides an almost ruler-flat digital to analog conversion over the range 0dB to -80dB. Below 80dB the D/A conversion is still well above average, all the way down to -100dB (see attached graph). The CD player's signal to noise performance is outstanding, and its overall performance is equal to the best top flight standalone CD players which I have evaluated in the last five years.

The FM tuner is very good, with adequate sensitivity, excellent channel separation and a frequency response that is almost ruler flat from 20Hz to 16kHz. The tuner provides 40 station presets for random access tuning.

In contrast, and regrettably, the AM tuner is only on par with the majority of other AM tuners. It provides a 4kHz band limited frequency response, which is appropriate only for listening to the news and other less demanding monitoring applications. The AM tuner is supplemented by a loop antenna which may be hooked onto the controller's rear panel.

As Yamaha were the inventors of Digital Sound Field Processor (DSP) systems, I was not surprised to find that the AV-1 includes programmable sound field processors to replicate outstanding examples of a stadium, disco, concert hall, rock concert, concert video or mono movie. I checked out their acoustical functions and was impressed by what the designers are capable of replicating in my relatively small family room.

The AV-1 also incorporates a Dolby Pro-Logic Surround Sound Decoder. As I discovered with a laserdisc player connected, it provides exciting and realistic sound field processing when the audio input incorporates Dolby Pro-Logic encoded signals.

One added bonus, which I discovered only late in the piece, was the unit's incorporation of a test tone generator. This facilitates convenient and extremely easy speaker level balancing adjustments.

Listening tests

I chose to install the AV-1 in my family room, near the TV set. I placed the controller on a cardboard box on one side of the room and the subwoofer in the opposite corner. I attached the five speakers to the wall in accordance with the manufacturer's recommendations. Then I was able to apply a series of critical tests, making use of conventional audio and video software.

With the assistance of the excellent handbook, I soon discovered that the AV-1 system is no slouch when it comes to generating high and even explosive sound levels. The system's one-third octave band pink noise response is within +/-10dB from 30Hz to 14kHz.

The AV-1 system is capable of generating peak outputs approaching 110dB, at which point compression limiting and distortion become readily apparent. The peak output at the low frequency end of the spectrum is more conservative, with the subwoofer's output limited to approximately 98dB. Audible distortion and frequency doubling must be expected when you try to push the wide band sound output in excess of 100dB.

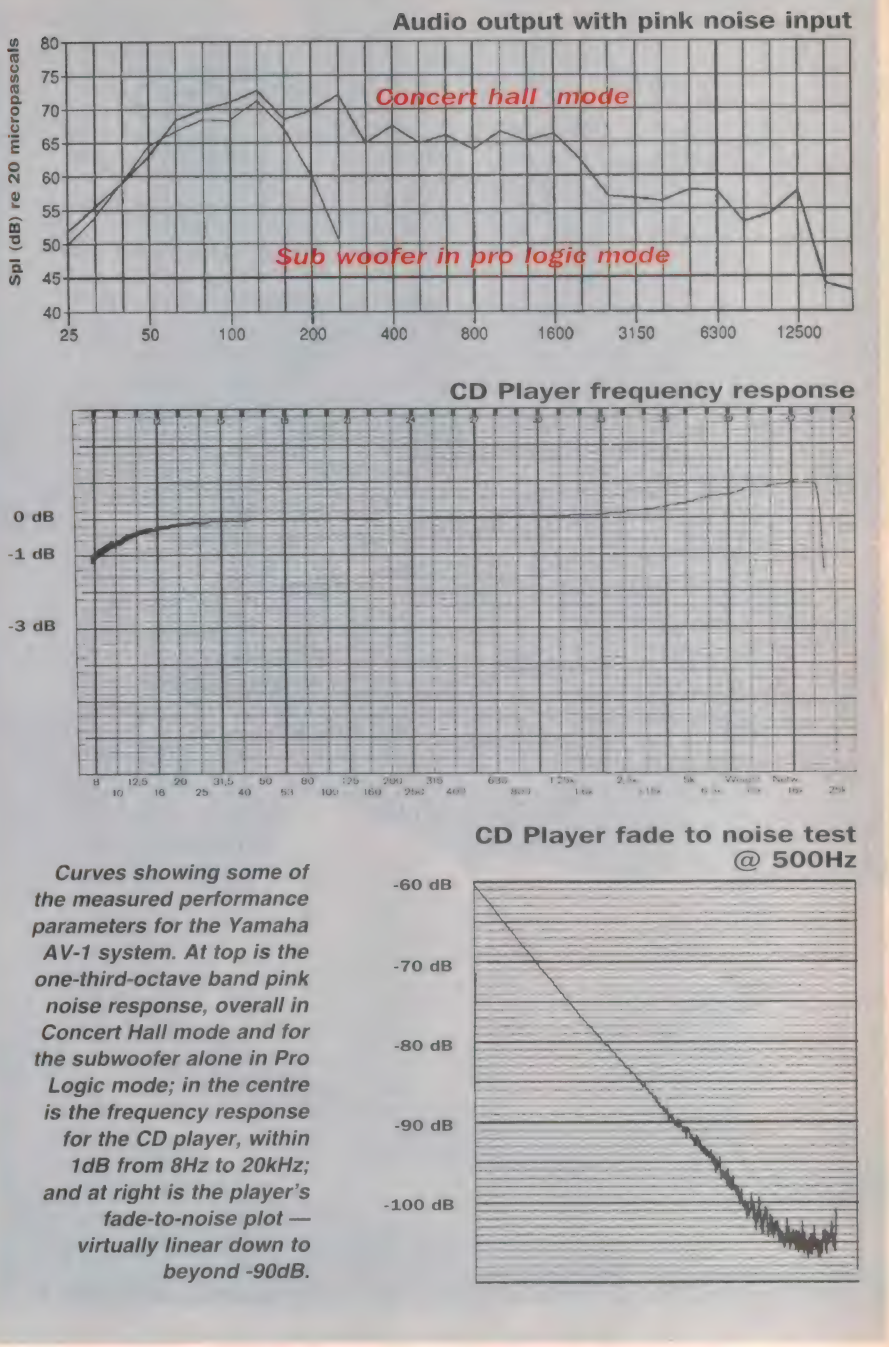
The on-screen display functions are practical and effective, providing volume settings, speaker balance adjustment, program names and TV monitoring functions. The large number of audio (and video) inputs provided ensures that you are able to exercise effective control over the diverse range of possible equipment that you may own, or wish to purchase.

The remote control is effective, and its buttons glow in the dark, which is quite an advantage. Unfortunately, though, the buttons are a tad too small and a little too close together for optimum ergonomic convenience. I would have been much happer if Yamaha had redesigned the remote control to achieve more 'user convenience'.

I used the AV-1 system for over a week, and was enthralled by its reproduction quality — which I would not have expected from such a small system. I played a CD album of re-released recorded music of Beniamino Gigli *In Opera and Song* (Nimbus Records NI 1763), which convinced me that Pavarotti still has some way to go to exceed Beniamino Gigli's superb voice. Although transcribed from 78rpm records, Gigli loses none of his flair in these recordings.

I also fed the AV-1 with a Yamaha Model S700 DVD player, which provided an outstanding audio-visual source. I soon discovered that the AV-1 has not been specifically designed to satisfy the expanded requirements of Dolby Digital systems, although it still provided outstanding two channel listening performance. I assume that Yamaha is already working on its Dolby Digital compatible AV-2 system...

The only improvement that I would recommend in the future 5.1-channel system is the provision of a remote control with larger keys, or with a wider spacing between them. ❖



Curves showing some of the measured performance parameters for the Yamaha AV-1 system. At top is the one-third-octave band pink noise response, overall in Concert Hall mode and for the subwoofer alone in Pro Logic mode; in the centre is the frequency response for the CD player, within 1dB from 8Hz to 20kHz; and at right is the player's fade-to-noise plot — virtually linear down to beyond -90dB.

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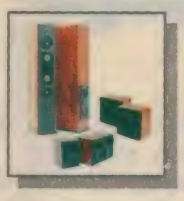

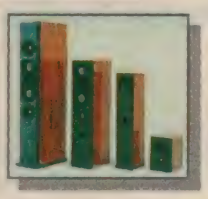

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EPILOG
to analog?

Digital camcorders have arrived, and the last days of analog models may well be drawing near. But Sony certainly hasn't given up on analog, having just released a new lineup of analog models boasting enhanced performance and plenty of enticing features...

by Barrie Smith

According to Sony Australia, DV (Digital Video) consumer camcorders account for 6-7% of present Australian sales. This compares starkly with the Japanese scene, where approximately 60% of sales can be attributed to DV units.

Obviously DV needs a kick along over here, either by price reductions — or perhaps by persuading customers to go digital, by squeezing the product flow of analog machines.

But this is not happening; we have just seen the release of a whole new slew of analog Sony camcorders in the composite Video 8 and component Hi8 formats. The launch was considered sufficiently important for Sony to hold special previews for an elite group of technical journalists in the company's North Ryde headquarters. To put the coating on the substrate, as it were, they even flew in two engineers from Tokyo for the briefing.

The briefing was extensive; the technology revealed in the new models surprising.

What's going on? Isn't it time for analog to roll over? Or perhaps, now that VHS/VHS-C are now defunct as camcorder formats, the Sony marketing men can see more milk left in the cash cow that 8mm video has been since its 1985 introduction. But is this a big ask?

There are now eight models in Sony's current lineup, five in Video 8 format and three in Hi8, as shown in Table 1. The prices range from low end to high — with features to match. But how, you may ask, can the company justify an 'ask' of $2999 for the dearest model, when only a few hundred more dollars would deliver to your operating hands a digital camcorder?

Sheer ingenuity is the answer.

For a kick off, all models feature a new XR (Extended Resolution) recording system in both the Video 8 and Hi8 camcorders. In XR,

Sony has shuffled the recording spectrum around to afford the video sector some more headroom. The benefits: Video 8's horizontal resolution rises from 240 lines to 280; Hi8 sees a comparable lift from 400 to 440 lines. The company feels Hi8's performance now nearly equals DV's figure of 500 lines of horizontal resolution. And I guess it does, if you don't happen to own a DV camcorder!

The benefits are, in one way, similar to the introduction of HQ refinements in VHS VCR units, resulting in an overall quality lift. The difference with HQ was that all manufacturers leapt into it; this time around XR is a Sony exclusive, at least as yet.

In day to day terms, it means you can record in XR quality on any of the new camcorders, replay from those, and enjoy the 10-17% lift in resolution. The XR recorded tapes will play back on other 8mm video devices, but you miss out on the boost to resolution.

So there are now *four* 8mm video formats. Are you ready for it? It seems Sony is, and the company is ready to reap the commercial benefits of an exclusive market advantage.

The company has already shown a fondness for format multiplicity in its professional video formats: its current inventory includes analog Betacam SP, Digital Betacam, digital SX and DVCAM (a pro version of DV).

Day for night

This writer has to admit to being more than startled by another new feature, included in seven of the new camcorders.

For years, camcorder manufacturers have waged war with their lux figures; some getting down to levels as low as 0.5 lux, whereat the light from a candle could be sufficient to shoot by. The problem has always been that maker A's lux figures could not be compared with maker B's, as differing methods of measurement have always been used.

Now Sony cuts a swathe through the whole thing by equipping most models in its new range with 'NightShot' — with the capability to shoot video footage at 0 lux. That's 0 as in zero light, or total darkness.

I was not so startled at the concept of shooting in total darkness, as this facility has already been around for a while in film still cameras — infra-red light sources and filters are easily accessible. What interested me was the inclusion of such an esoteric feature in essentially consumer camcorders.

I can envision Mum or Dad using their NightShot-equipped camcorder for a night shoot, then replaying the results — only to be mortally disappointed when they view the results of their efforts and discover negligible colour in the vision. But for security agents, night watchmen and gumshoes, what a machine!

The models equipped with NightShot are TRV35/99/512/89 and TR840. In application, a tiny pea lamp is sited behind a visually opaque panel on the camera's front. Trigger the NightShot function and the lamp illuminates. As it glows, an internal infra-red cut filter is lifted; in normal, full light shooting this IR filter is in the lens' light path, mainly to limit the deep red end of the spectrum.

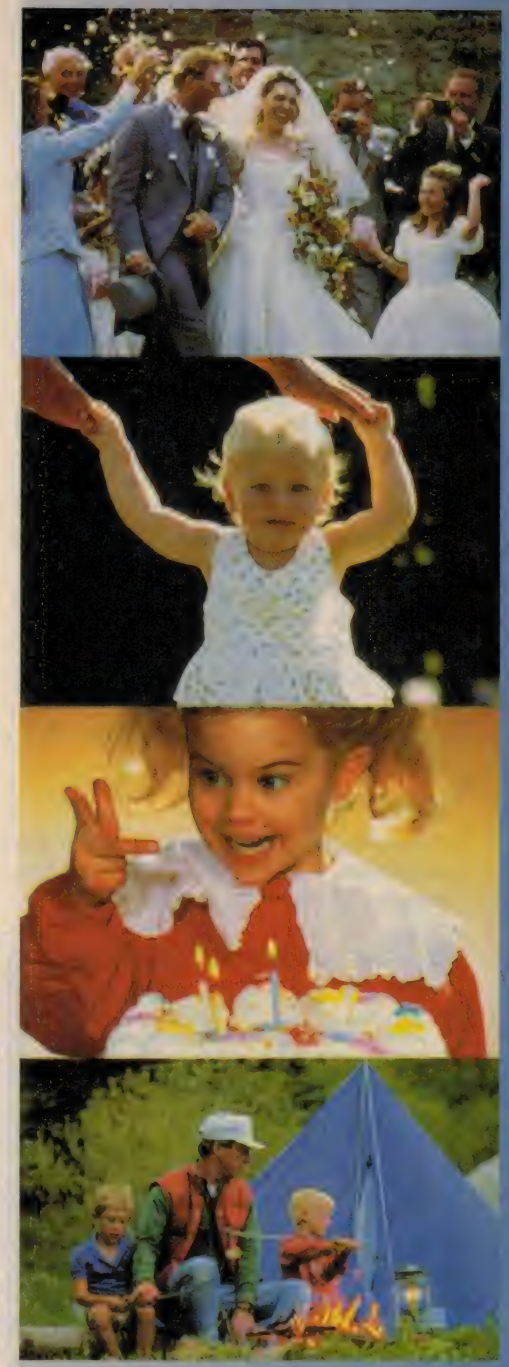
In normal setup the camera can operate within 0.4 to 0.7 lux levels, dropping to 0.1 lux when a special Low Light mode is selected in the camcorder's Program AE function. So you could honestly say that NightShot, with its zero lux ability, takes camcorders where none have previously dared venture!

The tiny 300mA IR lamp has enough power to illuminate subjects in total darkness up to three metres away. Tests shown at the press briefing showed that auto exposure and, more importantly, auto focus worked quite adequately in the difficult conditions.

If your nocturnal ambitions have a wider horizon, Sony can supply an accessory lamp which mounts onto the camcorder's hot shoe and enables IR coverage up to 20m distant. The lamp is two-way and can supply normal tungsten colour temperature light for interiors.

More power too

Almost single-handedly, Sony has raised the performance of camcorder batteries in recent



Upper left opposite: The new top of the range TRV99E, which provides all of the features of the new models — including built-in 'NightShot' IR illumination. With the new XR technology, Hi8 horizontal resolution achieves 440 lines.

Left: Some of the other models in the new Sony analog camcorder line up.

Upper right: Frames from 'family movie' recordings made with the new cameras. For analog technology, picture quality is excellent.

TABLE 1:
Sony models & prices

Video 8 format:	
CCD-TRV511E	*$1059*
CCD-TRV512E	*$1349*
CCD-TRV3E	*$1549*
CCD-TRV35E	*$1849*
CCD-TRV45E	*$2049*
Hi8 format:	
CCD-TR840E	*$1749*
CCD-TRV89E	*$2599*
CCD-TRV99E	*$2999*

years by the use of Lithium Ion cells, so removing the annoying memory effect of NiCads — and lifting performance. Sony's InfoLithium, with a reassuring viewfinder readout of power remaining, was a sure fire attraction for camcorder owners.

Now the company has released a 'Stamina' version of the InfoLithium battery, with the ability to operate a camcorder for up to 12 hours (with NP-F750/950 units). A recharge time of 15 minutes will allow one hour of shooting.

Some heavy rework has obviously been performed on the cameras' internal circuitry — including integration of a number of ICs, a lift in output of the LCD viewfinder (just as bright a picture, but less power drain) and overall lower internal operating voltages. A novel tweak was to reduce the size of the recording head gap, so demanding 10% less recording current. As if that were not enough, Sony also implanted a microprocessor in the battery to monitor camera performance and current demands.

Iconic look

A curse for many but a boon for others, the viewfinder menu display has gradually absorbed all the external controls for camcorders over the last few years.

The TRV89E, a Hi8 model offering almost as many features as the top of the range TRV99E.

The upside is a much cleaner exterior for the camcorder; the downside is that virtually all operating modes must be selected and adjusted by squinting into the viewfinder and tapping a few external keys and buttons.

Sony and Panasonic chose to install dual LCD colour and turret-mounted mono electronic viewfinders in their camcorders some time ago; as we all know, the LCD finders are virtually useless in full daylight, while the turret finder offers clarity in all conditions. So, on most occasions, to 'drive' the camera through all its procedures and in all conditions, you must aim the eye down the little black hole!

In an attempt to make this chore more friendly, Sony has altered the graphics used in the viewfinder menu — now we see small icons of a camera, tape cassette etc, alongside of which is a text label. This new look does make digging into the menu less of a bugbear.

Other niceties

In other respects the camcorders offer few other surprises. But it's hard to ignore the fact that the range of eight models is remarkably well configured.

A number of them offer LCD colour finders, ranging from 2.5 to 4" diagonal measurement. Most have an 18X optical zoom lens, with a 12X digital boost — leading to a final 220X zoom power. But bear in mind that the image quality at this extreme digital magnification is of little use.

All cameras have a Program AE system with six modes: spotlight, beach and ski mode, sunset mode (all of which tinker with exposure in difficult situations); soft portrait (depth of field is juggled to throw a close subject sharply into focus against a soft background sports lesson (higher shutter speeds); and landscape focus (defaults to infinity).

All have eight 'Picture Effect' modes: digital processing is used to create pastel, sepia, B&W, solarised and mosaic-ed images — as well as the ability to slim the picture or stretch it, and switch polarity so that a negative image can be transformed to a positive.

A highly attractive option for many is the capability for all camcorders to replay tapes as an NTSC signal to a PAL TV or VCR. One camcorder, the TR-840E, also includes a Time Base Corrector in its list of attractions.

Some of the higher cost models offer SteadyShot, Sony's electronic implementation of an image stabiliser. This is an excellent scheme, using as it does an oversize CCD to 'float' the live image and correct it for physical bumps before it is committed to tape.

Final word

I had the good fortune to view extensive tests made with both iterations of the XR recording system. Shown by the two Japanese engineers were A/B comparisons of XR and non-XR tapes, shot in Video 8 and Hi8. The improvement in image quality, especially in detailed subject material, was quite discernible with XR (in both formats) and would provide those who make first generation copies onto VHS a worthwhile lift in quality.

This is an impressive range of cameras — especially the bottom of the range model, which is a good buy at $1059 because of its feature list.

But look around, because digital camcorders are here. ❖

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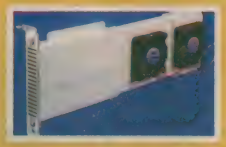

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Pioneer's 'Home Theatre in a Box'

A surround-sound system really adds a lot more impact to a home theatre setup, and can make viewing movies much more enjoyable — whether it be from videotape, laserdisc or the new DVDs. But assembling and setting up a full surround-sound system costs a fortune and is such a hassle, right? Not any more, with kits like the 'Home Theatre in a Box' package from Pioneer...

by Jim Rowe

Let's be honest. Until now, even we 'techie' types have found setting up a surround-sound system quite a daunting prospect. First you've had to assemble all of the necessary components — and there are generally quite a few. A Dolby Pro-Logic or other surround decoder, multiple amplifiers (or a multi-channel amplifier) to provide the right number of channels, as many as six different speakers in suitable enclosures, and so on.

Then there were the arguments about how all of these items were to going to be fitted into the room you'd planned to become the 'home theatre'. And finally, with *those* battles fought, there was the actual work of installing everything (including a lot of speaker wiring) neatly and unobtrusively. No wonder many of us decided not to bother!

But you can't avoid these things indefinitely, and with DVD players and discs at last starting to trickle into the stores, there's now an added incentive to become 'wired for surround'...

There *has* to be an easier way, though, surely? And there is, as it happens — in the form of keenly priced, complete surround sound system packages like Pioneer's 'Home Theatre in a Box'.

What you get in the Pioneer HTB is a large carton, measuring 970 x 580 x 445mm (the 'Box'), which turns out to contain four smaller boxes. And some of these turn out to contain even smaller boxes — a bit like one of those Babushka dolls, except that in this case most of the smaller boxes are speaker boxes. One carton provides the two main front speakers, another the centre front speaker and the two rear surround speakers, and a third the subwoofer. Inside the final box there's a Pioneer VSX 425 Four-Channel A-V Receiver, incorporating a full Dolby Pro-Logic surround decoder in addition to an AM/FM stereo tuner and four 50W (DIN) amplifier channels, and complete with multifunction remote control.

You also get a User Manual for the VSX-425 Receiver, and a brochure showing clearly how to wire it all up. And to make sure you have all that's needed in a typical home listening room, each of the speaker cartons includes sets of speaker leads, with bared and tinned ends on each conductor. There's even batteries for the remote control, and basic antennas for the AM and FM tuners.

The speaker system is probably best described as no-frills, with a passive subwoofer enclosure and fairly small 'satellite' speaker boxes for even the main front channels. These measure a modest 244 x 164 x 133mm, for example, which is virtually the same as the two rear surround channel boxes. Even the front centre channel box is only a little larger, at 350 x 165 x 133mm. Naturally the subwoofer box is larger again, measuring 455 x 310 x 225mm.

The satellite boxes all seem to be based on single 4" (100mm) drivers, with the front channels using 8Ω drivers rated at 100W, the centre front an 8Ω driver rated at 70W and the rear channels using 16Ω drivers rated at 40W. The subwoofer uses two 6-1/2" (172mm) drivers and is rated at 100W. All speaker boxes are of compressed chipboard, finished in black vinyl laminate — fairly spartan, but quite presentable.

Of course the fact that the speaker boxes are so compact will be a big plus for many people, ensuring that the system is not as visually intrusive as many of the boxes we techies tend to go for. Clearly, Pioneer's designers and marketing people are well aware that female family members often carry a fair bit of weight when it comes to buying decisions in this market area!

What we found

So how does it all go together? Very easily, as it turns out. The HTB brochure shows pretty clearly how to hook it all up, and also how to connect it to your TV, VCR and so on. Also the terminals on the subwoofer box are colour coded, and when you look carefully the speaker cables supplied are colour coded to match. Within about half an hour of starting to open the main HTB carton, I had it all connected up and ready to try out.

How did it sound? I have to confess that I wasn't expecting too much, after seeing and handling the modest little satellite speaker boxes — and also knowing that the

The main contents of the box: four small speakers for front and rear/right and left, a centre front speaker (lower left), the subwoofer (upper right) and the VSX-425 four-channel receiver, with Dolby Pro-Logic decoder and a very flexible remote.

HTB system has been designed to achieve a 'Volkswagen' price point rather than appeal to the true audiophile. But I was very pleasantly surprised...

Over quite a few hours, I listened to selections from laserdisc movies (some with Pro-Logic and/or THX tracks), as well as many of my reference CDs. And frankly, the overall performance was entirely satisfying in just about every respect. This may not be a high-end audiophile system, but it certainly seems to deliver enough clean audio 'grunt' to achieve what most people would find a very convincing home theatre presentation, in a typical domestic listening room.

(Even a quick check with the instruments showed a fairly flat response from about 45Hz to above 15kHz, with only a small bump at about 130Hz.)

I should add that although the VSX-425 Receiver is essentially down near the low end of Pioneer's range, its performance is nevertheless quite impressive. It certainly demonstrates how much manufacturers like Pioneer have been able to achieve, in providing ever more features and performance for prices that continue to fall (in real terms).

The VSX-425 can select video signals from your VCR or LD/DVD player, for example, along with the audio. And although it doesn't have a Dolby Digital (AC-3) decoder inside, its Dolby Pro-Logic decoder should be able to produce quite a satisfying result from most material — including from DVDs. It also has a line output to drive a powered subwoofer, if you wish to expand the system later on.

Other nice features I noticed were the way you can conveniently adjust things like surround mode, rear-channel delay time (15/20/25/30ms) and relative level for the surround and front centre channels — all from the remote control, in addition to the usual master volume, source select and so on.

Considering its compactness, convenience, performance and very attractive price, then, Pioneer's Home Theatre in a Box has a lot going for it. For most people, I suspect it's likely to fill the bill very nicely indeed. ❖

Pioneer 'Home Theatre in a Box'

A compact and well priced surround sound system, mating a 4 x 50W receiver with built-in Dolby Pro-Logic decoder, five satellite speaker boxes and a passive subwoofer unit. Comes as a 'complete solution in a box', with all cables etc.

Good points: *Impressive sound, considering low cost and compact, unobtrusive speaker boxes. Provides a surprisingly wide range of functions and facilities, accessible from the remote.*

Bad points: *Doesn't include Dolby Digital (AC-3) decoding. May not have enough power capability for really large rooms.*

RRP: *$999.*

Available: *Most Pioneer dealers. For more information contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195.*

The Yin & Yang of China's Television

Television broadcasting in China turns 40 this year. Thomas E. King traces its development and the expanding role of satellites in bringing viewer choice to people living in the world's most populous country. He also looks at Mongolian Television (MTV).

Long before Hong Kong (Britain's last major colonial possession in Asia) reverted back to Chinese rule on July 1 last year, a panel of specialised personnel at China Central Television (CCTV) began devising a comprehensive plan to televise the historic handover ceremony and following festivities to viewers throughout China and around the world.

It was decided that in order to provide the level of service required by broadcasters worldwide and to carry simultaneous coverage of this 'pageant of transition' in Beijing and Hong Kong, CCTV would need to set up broadcast facilities in both centres.

An International Broadcasting Centre (IBC) was subsequently located on the first floor of the CCTV Building in Beijing. In the former territory the CCTV broadcast hub — a 485m^2 purpose-built broadcast complex — was established within the Hong Kong Convention Centre (HKCC). This was supplemented with an 80m^2 'mini' broadcast centre, established inside the 37 storey Grand Hyatt Hotel, which became the 'home base' for some 280 reporters and journalists.

Technical equipment and supplies for both communication centres included the largest number of 'Outside Broadcast' vans ever used by CCTV for a single event. The eleven OB vans topped a long list of equipment and supplies that included three helicopters, the latter being used in a variety of applications such as the coverage of the People's Liberation Army (PLA) entering Hong Kong on the eve of the handover.

Live coverage of this event, as well as prerecorded programming from Hong Kong and live coverage from other parts of the world, was beamed via satellite to the CCTV master control room in Beijing. Live coverage of activities in Beijing's Tiananmen Square and elsewhere in the Chinese capital, on the other hand, was sent via microwave to the master control room. From there signals went to the CCTV production and broadcast control rooms, then to the IBC and finally to the CCTV satellite uplink site, some 30km outside the city.

(Viewers in the six million-strong capital receive their TV signals from transmitting

The control room for CCTV's 1000 sq metre main studio in Beijing. Centre: The Central Radio Television Tower receives signals via optical fibre cable from the CCTV Complex and then transmits them to the six million residents of Beijing.

Above, left: inside one of the studios at CCTV headquarters in Beijing; right: total of 11 OB vans from China Central Television were deployed during the Hong Kong handover broadcast.

antennas on the Central Radio Television Tower (CRT). Located to the northwest of the CCTV Complex, the CRT receives signals from CCTV's eight channels via optical fibre cable and then transmits the programmes to Beijing viewers.)

21 transponders

A total of 21 satellite transponders on AsiaSat-2 and PanAmSat-2 were used during the coordination and telecasting of the Hong Kong handover.

This was, by far, the most extensive and expensive production undertaken by CCTV in its history, a television story that began with test transmissions on May 1, 1958. Scheduled programming of two hours a day on a single channel commenced the following September. The second CCTV channel was added in 1973, the same year PAL-D colour transmissions began.

CCTV-1 broadcasts a wide range of programmes, with an emphasis on news and current affairs while the focus of CCTV-2 is on economic, social and educational topics.

Going to air in 1986, CCTV-3 is an arts channel presenting operas and classical music while CCTV-4, also known as 'CCTV International' and presenting programming in Mandarin, Cantonese and English targeted at overseas viewers, began six years later.

The accent of CCTV-4 is on news and current affairs, although some 56 different programmes are seen — ranging from investment guide shows, programmes on tourism and language instruction to women's shows plus TV dramas, cartoons and game shows.

CCTV-5, a sports channel, and CCTV-6, a movie channel, along with CCTV-3 are domestic pay TV channels accessed by way of authorised decoders.

Since 1995, CCTV-7 has provided dedicated programming for children, agriculture, the military and science subjects while CCTV-8, which started in late 1996 is devoted mainly to the arts and entertainment.

Over 900M viewers

Using both a nationwide microwave network and an extensive satellite transmission system, CCTV-1 reaches about 84% of the total population of China. This means that the number of regular viewers watching predominantly locally produced programming exceeds the 900 million mark!

Now in common use, satellites have only been used for programme distribution since August 1985 when a transponder on Intelsat 5 was first employed for CCTV-1. A series of 53 TVRO sites was set up in a Government initiative to introduce TV services to remote and mountainous areas of the vast country. Another Intelsat 5 transponder was leased in February 1987 for CCTV-2.

Owned by the Chinese Post & Telecommunications Ministry, China's first communications satellite, DFH2, came on line in 1986. It was launched into a 103°E orbital slot and used for radio services of China Education TV (CETV), a dedicated educational outlet operating a two channel educational TV network and a multi-channel radio network.

DFH2A1 was launched in March 1988 into an 87.5°E location. CCTV-1 and CCTV-2 transmissions were soon thereafter relocated from Intelsat 5 to this relay station.

DFH2A2 was launched in December 1988 into a 100.5°E orbit for primary use by CETV. Two years later its predecessor, DFH2A1 experienced difficulties so a North Beam transponder on AsiaSat-1 was leased.

In mid 1993, with demand increasing for

more transponders and the end of the service life for DFH2A1 eminent (it ceased operations in August 1993), the Chinese Post & Telecommunications Ministry signed a purchase agreement with the General Electric Co. for an existing satellite.

The 36 transponder-equipped satellite was moved to 115.5°E and renamed 'ChinaSat 5'. CCTV transferred its satellite TV services to this higher power machine, which was in operation until 1996.

Since the middle of last year, Apstar 1A — the Chinese Government has a shareholding in this satellite — and AsiaSat have been used as platforms for the domestic satellite service. CCTV national channels 1, 2 and 7 as well as regional and local TV transmissions from 17 provinces and cities are to be found on transponders leased on these two satellites.

CCTV also uses Ku-band transponders on AsiaSat to send digitally compressed channels 5, 6 and 8, as well as channel 3, to a national audience. (CCTV started using digital compression on January 1, 1995.)

As CCTV-4 serves an international audience on a 24 hour a day basis — and can even be seen in some Australian centres through Pay TV agreements — its broadcast formats and technical means are more involved.

During its early days the multilingual CCTV-4 was put on the Russian ST-14 satellite to reach overseas audiences. Today, CCTV-4 uses seven transponders on five different satellites to achieve global coverage: from AsiaSat-1, a C-band NTSC analog CCTV signal; from AsiaSat-2, a C-band analog PAL signal and a C-band analog NTSC signal; from the PAS-2 Pacific Rim Beam transponder, a digital C-band CCTV signal; from the PAS-3 Africa and Pan America Beams digital C-band signals; and from the PAS-4 South Asia/Middle East Beam, a digital C-band CCTV-4 signal.

Global coverage for the news and general interest programming of CCTV-4 was achieved on April 1, 1996. More recent has been the introduction of the CCTV-3 international service, which now brings Chinese art and culture to an expanding worldwide audience using the latest technology in satellite delivery. ❖

Mongolia Television facing new challenges

Executives within Mongolia Television (MTV) are optimistic that a cherished dream will come true: to telecast the arrival of the year 2000 with state-of-the-art broadcast equipment, even though much of what is in use today in the television as well as radio divisions of the state-owned and financed national broadcast organisation was manufactured in Hungary in the early 1980s.

"SECAM is still the transmission standard", said Mr Dashdongdog Davaasuren, Director of Mongolian Television. "It's a holdover from Soviet days, but we are slowly replacing transmission and studio equipment with modern units from France and Japan with the intention to go to full PAL", he said.

The initial phase of a three stage US$38.3 million re-equip plan drafted in consultation with the Asia-Pacific Broadcast Union has yet to be realised. Despite this, MTV executives envisage that their goals will be reached by early next century, though the re-equip plan calls for full financing by donor countries.

Assistance is being solicited, with MTV officials citing ongoing successes in linking the nation's 2.5 million (predominantly illiterate) people to the outside world.

This began 31 years ago when MTV commenced TV transmissions in Ulan Bator (now seen spelled as 'Ulaanbaatar'), the capital of this landlocked Central Asian nation that is larger than the Northern Territory.

Initially MTV broadcast a total of 10 - 12 hours of programming per week, spread over four days. Microwave retransmission links were established in 1972 to broaden MTV's coverage, which took another leap forward with SECAM colour broadcasts beginning in 1981.

Today MTV transmits 39 hours of programming a week. Near national coverage is achieved by a network of 70 microwave retransmission sites and 300 low power satellite rebroadcast sites, in provincial centres and towns.

An AsiaSat-2 transponder (100.5°E on 3.680GHz vertical) is currently used to feed these dish-equipped remote retransmitting stations. (These have been observed in Australia by satellite TV enthusiasts.)

About 90% of the population is reached by an MTV signal, although the lack of a national electricity grid restricts viewer access to television in more remote areas.

In Ulaanbaatar MTV broadcasts its programmes on the VHF band, using a 5kW transmitter to blanket an area with a radius of 30km.

Located on a hill behind Ulaanbaatar's picturesque Gandan Monastery is the headquarters for Mongolia Radio and Television. Below: Solar energy is being increasingly used to power solid state TV sets in remote rural locations.

Mr Dashdondog Davaasuren, Director, Mongolian Television (left) and Mr Purevjavyn Bayarsaikhan, Director Radio Mongolia, are confident of the future for the national broadcast organisation despite many challenges.

"More than a quarter of MTV's current broadcast time is devoted to news and public affairs programming, because it's a big country and we are the only source of news for people far from the capital", said Mr Davaasuren.

Further technical advancements, particularly in the use of satellites, have enhanced the broadcaster's capabilities. For instance, the broadcaster has access to Worldnet and CNN from the USA, Japan's NHK and Deutsche Welle from Germany. Selected programmes from these networks, most notably important news and current affairs, are translated into Mongolian for broadcast on the national TV channel.

Though this is by far the predominant channel it's not the only viewing option from the government broadcaster. MTV also retransmits the Russian public TV channel ORT-1 to all of Mongolia's urban centres and over 300 rural settlements.

Though Mongolia achieved independence in 1990 after nearly 70 years of Soviet domination, it seems that subtle ties with the former superpower may well remain for many years to come. ❖

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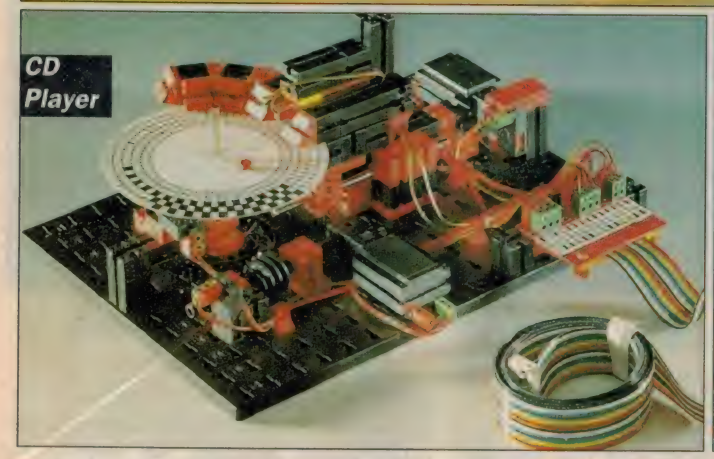

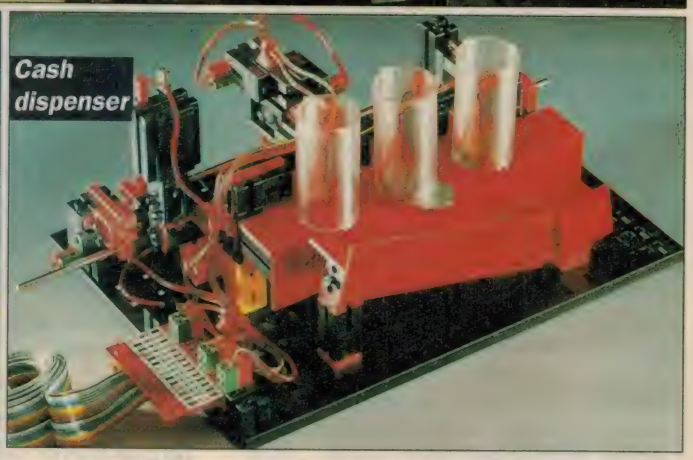

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MUSEUM ON THE MOVE

Britain's famous Museum of the Moving Image — MOMI for short — is on the move, in more ways than one. Having filled its existing space, it's now planning to spread its wings. So when next you're in London, perhaps you might consider giving those old stone and portcullis attractions the flick — and go to the flicks instead.

by Barrie Smith

Having spent much of my ill-spent youth tramping the cobbles and mews of the old city, my tastes nowadays, when it comes to gaping at ancient monuments are now decidedly post-modern. I would much rather be enthralled at a piece of 19th-century engineering than to slaver over the path that Anne Boleyn strolls, with 'er 'ead tucked underneath 'er arm...

So, if you feel the same way, I suggest you head South Bank way and check into MOMI — the Museum of the Moving Image. Aside from the Langlois museum at the Cinematheque in Paris, the London venue is arguably unequalled as a vivid and tactile record of movie making.

Opened by Prince Charles in 1988, the museum cost £12 million in total, of which £7 million was spent on the building and contents while research consumed the other £5 million. The total cost was completed without any form of government subsidy — no doubt because of the then-ruling Tory distaste for public funding of any sort. When you see, or in fact even manage to find MOMI, shoved tightly in beneath Waterloo Bridge, you have to wonder where the £7 million actually went to!

The museum occupies three floors. Entering through the lower floor you can wander through working demos of early optical toys, projectors and examples of early experiments in persistence of vision — to examples of Muybridge, Edison's, Melies' and the Lumieres' work, the British film pioneers and on up to the beginnings of Hollywood.

The main and largest floor houses relics of the early days of silent movies in many world cultures — French, German Russian etc. There is even a replica of a rail wagon mobile cinema used to spread the word of the Revolution throughout Russia in 1919, complete with Eisenstein movies on a small screen and an 'interactor' — a husky voiced, female guide spruiking the party line in heavily accented English. D.W. Griffith's work is also there, as is Fritz Lang's, along with exhibits depicting the coming of sound and television.

A re-creation of Robertson's Fantasmagorie — an 18th century horror magic lantern show.

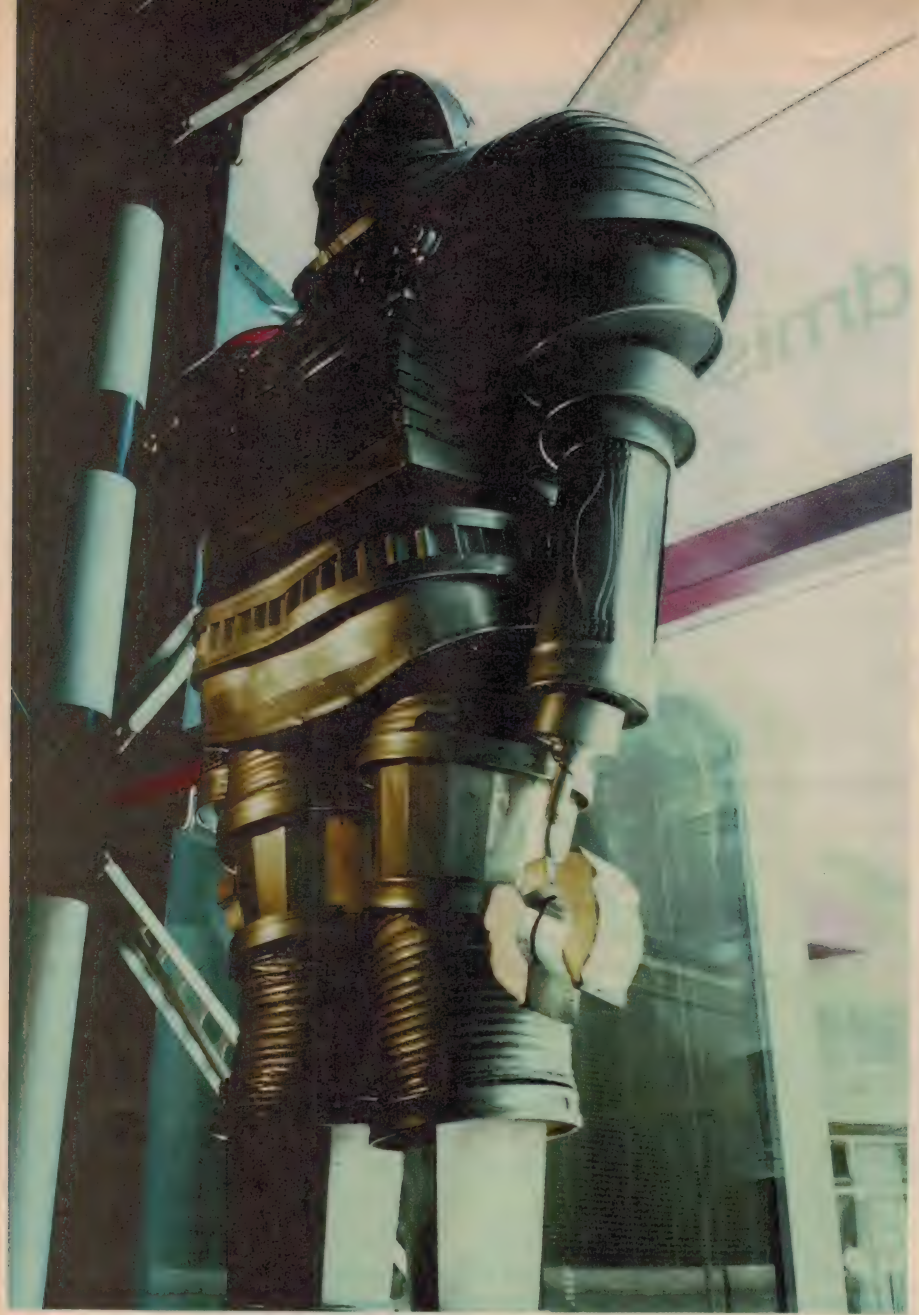
On top, in the smallish upper gallery (you can almost feel the bridge traffic pounding over your head!) is a working TV studio, with a special effects suite where the kiddies can chroma key themselves pseudo flying over an aerial shot of the Thames.

In around three hours I soaked up all I needed to know about movie and TV making. If you have children you could take longer and, quite frankly, the best way is just to get lost in the archive, retracing your steps when you need to.

But be warned: visit the seductively stocked shop (immediately before the exit) at your financial peril. The museum's marketing people admit that the shop (and nearby cafe) are valuable revenue raisers for the cash-strapped attraction. Not surprisingly, tee-shirts run out at £10-20, while replica Zoetropes can be bought for around £25.

Laser discs

There are 44 different exhibition areas within MOMI, spread over 3000 square metres. Each year, up to four special features are staged in a dedicated exhibition space. Every attempt is made to run film as film, and video as video: in one exhibit a 65mm handmade film was spooled back and forth, while 16mm ran in a first World War mini theatre. Otherwise 35mm had hold elsewhere, while video appeared to be handled with presentations from analog laser disc players — 70 of them in all.



Dr Kellerman's robot from the Dr Who TV series 'Robot'. A good 2.5 metres tall, it 'grew' to over a hundred metres on screen.

A total of 27 cameras is sprinkled around the building, watched on monitors in a central control room. Naturally, like virtually everything else, the control room and hapless operator are on display! Here the tenant of the 'goldfish bowl' controls sound and light levels and supervises the interactive exhibits. The technology in this nerve centre did not appear to be 90s state-of-the-art, but firmly locked into the period of the museum's genesis — the late 80s. I was amused to notice that the museum catalog crowed that the audio for the single Dalek (from *Dr Who*) on show was drawn from 'a digital store with no moving parts to wear out'.

Hercules meets Scarfe

On my visit, an absorbing display and investigation was under way to explore the connection between British cartoonist Gerald Scarfe (it was he who created the acidic cartoons which top and tail the *Yes, Prime Minister* TV series) and the output by the animators at the Disney studios. It comes as something of a surprise to discover that even as far back as *101 Dalmatians* (1961), his work influenced the Disney people. Now his style is right up to date as it appears in the new *Hercules* animated feature. Scarfe was contracted to supply designs and art direction for the Greek hero's life story.

A small theatre inside MOMI runs an annual programme of 360 classic films — expect to see a variety of titles, from *Odd Man Out* (1946) to *Red Shoes* (1948) to *High Noon* (1952). A charge of £5.75 is made for these special evening screenings. The big plus is that new or restored 35mm prints are used for these screenings.

Strolling around the animated or stationary exhibits, it is a surprise to come across a real person working in a small animation studio. Britain's Channel 4 funds an animator-in-residence to a total of £4400, to work unfettered (apart from the ogling and pressed noses of the general public) for a three-month period. The final work is then considered for broadcast on the network.

Southern drawl

Spying a somewhat overdressed young lady, dressed in a richly embroidered, heavyweight burgundy coloured velvet gown that seemed a little out of place (it was 30°C outside), I was taken aback when she strolled over and related in a fine Southern drawl how her husband had left her in Paris, leaving her (as far as I could work out) to fend for herself. I may have got this wrong, but it appeared she had picked up a little freelance work operating one of the new public cinema machines, then the high craze in the French capital...

The year was 1892. The machine was Reynaud's clever Theatre Optique (or at least a replica of it). The captivating show was run with a print apparently made from an original hand-coloured 65mm negative; one projector threw a stationary image on the small screen while the benchbound projector carried the 65mm film frames bounced off a sectored, mirrored drum onto the same screen. The deft young Southerner rocked and rolled the 'movie' and displayed a convincing semblance of movement which, in its original period, pleased the customers until around 1900 — by which time 'real' movies took hold. It is believed the despondent Reynaud threw his loss-making machine into the Seine.

Other corners of the museum used the same scheme of interactors to make the technology live. This works well in the main, but I have to admit I find talking to a richly dressed 19th-century belle distinctly unnerving, when you happen to be wearing a 20th century tee-shirt and jeans.

The idea is a relatively common scheme to find these days in re-creational attractions — even the Gold Coast's Movie World has stunt men, born in Mt Gravatt but sporting faux Yank accents that are about as authentic as Thai-made Levis.

An Electric Cinema ('Admission Tuppence') gains much from another interactor, in brown suit and bowler, who welcomes an audience to a showing of silent classics at a replica of Britain's first luxury cinema, the Omnia-Pathe established in Lanacshire in 1907.

Britain's newsreel industry both before and after WW2 was a thriving one, and a Movietone news car with a roof-mounted 35mm camera represents this era. Two of the Samuelson brothers, David and Michael

were Movietone news cameramen, so it is fitting that many exhibits have come from the Samuelson archive — the company the brothers established is now a worldwide film equipment company.

A camera crane used on Hitchcock's film *Under Capricorn* (1949) is topped by a Mitchell BNC camera, parked immediately outside the Odeon cinema — complete with circa 1930 commissionaire.

The inception of television is covered by static exhibitions and TV sets of the period; there is some programming running, but it is mainly British-originated. You may find this section a little disappointing, as I did. But as curatorial representative Jane McCarthy admitted, the museum begins with "pre-cinema and ends around 1958" — adding that the conceptual people at MOMI are "looking at a more modular structure for the new museum".

'New' museum

Marketing woman Anna Butler confessed to me that when MOMI opened "things like actor interpreters, a lot of the ideas we had and the interactors were very new. Now a lot of our museums are doing them, and nationally, not just in London. Now we need to think, what's the next thing, how do we move on from there?"

One of the few TV receivers on display — a Pye set of 1949.

Children are encouraged to create animations for replica optical toys.

And a 'new' museum is imminent, as it confronts terminal, spatial starvation as more and more exhibits demand more and more space.

I understood from talking to a number of other backroom people at the museum that it is expected that the National Film Theatre, a co-tenant of the 'site' (if the interior of a shoebox could be called a site!), is to move out in the near future, so leaving room for MOMI to expand.

Nearby is a busy roundabout, quaintly named the Bullring. This will house London's first IMAX theatre, designed to also handle conventional 35mm and 70mm film presentations. The new theatre will be a 500 seat, purpose built venue, expected to have one of the largest screens in Europe, approximately 20 by 30 metres, for showing 2D and 3D films.

It seems that jamming of IMAX cinemas into heavy traffic beset, crammed corners of the world's capitals is a growing preoccupation for late-90's architects and their client entrepreneurs — witness Sydney's first IMAX theatre, wedged between two freeways and a four-lane highway!

In the Top 15

MOMI is considered to be in the top fifteen 'most often visited attractions' in London. However efforts are now made to discourage use of the acronym MOMI, as research showed people didn't understand what MOMI meant and often confused it with MOMA, the Museum of Modern Art.

So MOMI is undeniably up there as an attraction equal in popularity with the Tower of London, the Science Museum, the Victoria & Albert and Madame Tussaud's. It welcomes over 400,000 visitors a year and spends an amount close to £250,000 in promotion. In the nine years since it opened the museum has pulled 2.5 million visitors, of which 30% have been school and educational visitors.

In hindsight, though, the setting up of MOMI in the first place could be said to have embodied a brave, but in many ways flawed strategy. Yes, the place was built, the collection assembled, and a large amount of industry support garnered. But it now seems the museum is facing other struggles, as it strives to remain solvent.

Australia's turn

David Watson, now with Sydney's Museum of Contemporary Art, help set up MOMI in the early days. He is now Project Co-ordinator for the planned MCA Cinematheque, to be established to the immediate north of the existing Circular Quay-side MCA.

So we'll be getting a Cinematheque. What does that mean? Three custom designed cinemas, able to screen film gauges from 8mm to 70mm as well as able to offer video projection. A specially restored cinema organ, together with variable-speed projectors will enable silent screen classics to be exhibited, while simultaneous translation facilities will allow unsubtitled films and videotapes to be shown.

But in contrast with MOMI, which is a museum, the Quayside venue will be a screening resource centre, able to tap into global archives and curated presentations. ❖

EA's Web Site

The Electronics Australia World Wide Web site is now operational, in a preliminary form. On it you can access and download all of the files available on our very popular Reader Services BBS — including project index files, software for our projects, notes & errata, useful shareware and so on. You can also see what's in the latest issue, and even take out or renew a subscription to the magazine if you wish. We'll be adding extra features and services as we go along, so please pay us a visit at:

www.electronicsaustralia.com.au

Forum

Conducted by Jim Rowe

Dr Beck's 'Brain Tuner' — and the many uses of TENS...

This month we're rounding off our discussion of the 'alternative electrotherapy' devices promoted by US researcher Dr Robert Beck, with a quick look at his Brain Tuner. This leads us into a discussion of Cranial Electrotherapy Stimulation (CES), which in many ways seems to be an offshoot of TENS/TNS: transcutaneous neural stimulation, itself now quite widely accepted as a treatment for chronic pain.

So far in our look at the alternative electrotherapy devices developed and promoted by Dr Robert Beck, we've mentioned his Blood Cleaner and Magnetic Pulser — both claimed to be capable of curing all manner of serious ailments. We've also seen that although his Blood Cleaner in particular seems to be based at least partly on work done by researchers at Albert Einstein College of Medicine in New York, which resulted in US Patent 5,188,738, there still seems to be a fair bit of skepticism about its efficacy — especially in legitimate medical circles.

Still, Dr Beck himself is apparently assisting in controlled studies in the San Diego area, which presumably could yet come up with some more convincing evidence to support the claims made by him and his many followers. It'll be interesting to keep an eye out for any reports of this; I imagine that if the results *do* tend to support Dr Beck, this will be trumpetted pretty loudly on web sites like that of North American Beck-device manufacturer and promoter Sota Instruments Inc (**http://www.sota-inc.com**).

In the meantime, let's move on to look briefly one more of Dr Beck's devices, known as the Brain Tuner. As soon as I saw mention of this I was a bit intrigued, because the name conjures up all kinds of possibilities — from brainwashing to lifting the IQ. In reality, though, it seems to be somewhat less 'way out' than most of Dr Beck's other devices, being promoted almost entirely as an aid to relaxation and stress relief.

With my limited time and resources I couldn't find much on the Brain Tuner written by Dr Beck himself, but on the Sota Instruments web site I did find a good description of both the versions of the device sold by them, and the principle it's claimed to operate on. There's also a picture, which shows the electrode system supplied with the Sota instruments. Hopefully Sota won't mind me reproducing the picture, as this will give them a bit of free advertising. It's shown below.

According to Sota, the Brain Tuner was developed by Dr Beck in 1983. It delivers 'minute levels of relaxing energy' through electrodes placed one each side of the head, just behind the ears. These 'micro-current energy pulses appear to have a profound balancing effect on the individual and tend to produce a state of over-all relaxation and well being'.

Actually Sota seems to sell two versions of the Brain Tuner, the 'basic' model BT-5 (US$295) and the 'Professional' BT-6 (US$395), which is microprocessor controlled and offers crystal-locked stable and precise output frequencies and timing. It produces a 7.83Hz 'voltage modulated pulse' and automatic shut-off after 30, 45 or 60 minutes...

OK, then, so the Brain Tuner(s) apply low-level pulses between electrodes on either side of the head, which is claimed to reduce anxiety and stress, and also be of benefit in treating depression and insomnia. But what's the principle of operation?

Well, it appears that there's actually quite a bit of evidence supporting this technique, which goes under a number of names. It's variously called cranial electrotherapy stimulation (CES), electrosleep, electroanesthesia, transcranial electric stimulation (TCES), transcranial electrotherapy (TCET) and neuroelectric therapy (NET). Dr Beck didn't invent the idea, which seems to have been around since early in the century.

One of the Beck-designed Brain Tuners marketed by Sota Instruments, as shown on their web site with a matching dual-electrode band for CES .

A quick rundown on CES

Here's a quick historical rundown and explanation, extracted from some material I found on the Sota Instruments web site:

Cranial electrotherapy stimulation was first called electrosleep because it was thought to induce sleep. Rabinovich, a Russian, is given credit for making the first claim for electrical treatment of insomnia in 1914. In 1957, in the USSR, Ana'ev published the first paper on CES.

The first book, simply titled Electrosleep, was published a year later by Gilyarovski. This generated a high degree of interest in the then-known Eastern Block countries and CES was soon adopted as a treatment modality. In 1959, Obrosow reviewed the CES literature and published the first American paper on CES. By 1966 the first International Symposium on Electrotherapeutic Sleep and Electroanesthesia was held in Austria. The use of CES had spread worldwide by the late 1960's when animal studies of CES began in the US at the University of Tennessee, and at what is now the University of Wisconsin Medical School. These were soon followed by human clinical trials at the University of Texas Medical School in San Antonio, the University of Mississippi Student Counseling Center and the University of Wisconsin Medical School.

The most comprehensive review of the research in CES published to date is a chapter by Ray B. Smith, PhD in the book, Neural Stimulation, published in 1985. Dr Smith has been researching CES since 1972. He concluded, "There are 40 studies of CES readily available in the US in which the dependent variable is reliable. When these are examined alone it becomes apparent that CES is effective in alleviating symptoms of anxiety,

depression, and insomnia. CES appears effective as a treatment for withdrawal in the chemically dependent person. Other promising areas of treatment are in hypergastric acidity and migraine headaches."

Dr Smith adds, "CES appears to be safe, with no harm or negative side effects having been reported to date in controlled studies. Finally, while one usually assumes some placebo effect from a treatment as dramatic as this, none has been reported in studies controlled for this effect."

Scientists at Harvard have recently analyzed all the literature on CES worldwide, and have also found it to be an effective therapy although they are holding their findings confidential until their results are published.

Open marketing of CES devices began in the 1970's in the US for the treatment of anxiety, depression and insomnia. Several thousand Americans are treated with CES annually by thousands of doctors and it is estimated that more than 50,000 people in the US own CES devices which have been prescribed for home use. No adverse effects or contraindications have been found from the use of CES, either in the US or in other parts of the world.

As with all electrical devices, caution is advised during pregnancy and for patients with a demand-type pacemaker. In addition, it is recommended that patients not operate complex machinery or drive automobiles during and shortly after a CES treatment...

...Cranial electrotherapy stimulation is believed to stimulate the production of endorphins. It probably also affects the hypothalamus, causing changes in the hypothalamic neurohormonal regulatory mechanisms and the reticular formation of the brain stem. The reticular activating system is involved in a myriad of behavioral expressions from alertness to sleep. This "attentional center" plays an important integrative role in the functioning of mind and body.

Similar, but different

Later in the same discussion, there's a good description of CES devices in general, and their use:

Cranial electrotherapy stimulation devices are generally similar in size and appearance to standard transcutaneous electrical nerve stimulators (TENS), but produce very different waveforms. Standard milliampere-current TENS devices must never be applied transcranially.

CES electrodes can be placed bitemporally, bilaterally in the hollow behind the ears just anterior to the mastoid processes, or clipped to the earlobes. This depends on the device being used.

Most CES devices produce a pulse repetition rate (PRR) of 100 hertz (Hz) which was what the original Russian devices used. Some produce a PRR as low as 0.5, or as high as 15,000Hz. The current is usually increased by the patient until a mild tingling sensation is felt at the electrode site, or a slight vertigo (dizziness) is experienced. It is then adjusted back down to a comfortable level below that which produces vertigo or an unpleasant feeling of electrical current. It may take a few minutes before the current needs to be reduced.

Generally, a treatment time of 20 to 40 minutes is best, daily or very other day.

Immediately after a CES treatment, patients usually report feeling more relaxed. Some people feel somewhat inebriated for the first few minutes. This is a pleasant and very comfortable sensation. After several minutes to hours, the lightheaded feelings usually disappear, the relaxed state remains and a profound sense of alertness is achieved. This relaxed/alert state will usually remain for an average of 12 to 72 hours after the first few treatments and then becomes cumulative from a series of treatments.

Most patients relate feeling more relaxed, less distressed, while their minds remain alert and even more focused on mental tasks. They generally sleep better and report improved concentration along with heightened states of general well-being.

Elsewhere on the web, at the URL **http://www.northwest.net/tri/ata14/anxstre.htm**, I found a summary of some 78 differ-

ent research studies into the use of CES for treatment of anxiety, depression, drug abuse and similar ailments, and most of the studies seemed to suggest that CES is indeed capable of offering help with these problems...

So there you are — despite its rather offbeat name, Dr Beck's Brain Tuner seems to be a fairly standard type of CES device, and somewhat more credible than his other devices. Mind you, there seems to be a huge amount of variation among CES devices in terms of current waveform/pulse duration, current level, repetition frequency, electrode placement and so on — so the exact significance of the 7.83Hz PRR and behind-ears electrode positioning used by the Beck/Sota devices is probably moot. But my guess is that it probably works at least as well as most other CES devices.

Of course I haven't had the opportunity to try one out, and judging from the response I got from Sota when I tried to contact Dr Beck through them, I doubt if they'd be too keen. But by sheer good fortune, a couple of weeks ago I had the chance to try out a similar — although it appears somewhat more flexible — product made by a firm in Melbourne, Bio Electronics Pty Ltd. I also had the opportunity to learn more about CES, TENS and the work that's been done on developing these technologies, right here in Australia...

One of Bio Electronics' Sportsmed devices, which can be used for both TENS/TNS and CES. It's shown here with a set of rubber electrodes for TNS use.

Local pioneer

It happened this way. A couple of weeks after publication of the February issue containing my second column dealing with the more dubious electrotherapy devices, I was contacted by Trevor Andrews, the marketing director of Bio Electronics. Mr Andrews expressed support for our attempt to throw light on some of these less credible devices, and explained that his company was a long established one with a world-wide reputation for developing, manufacturing and marketing much more credible electrotherapy devices.

It turned out that the founder of Bio Electronics, William J. (Jim) Lamers, is a highly respected pioneer in the field of TENS/TNS/CES devices. Trained in physiotherapy during the late 1940s, Mr Lamers spent seven years as physiotherapist for the Essendon and Footscray Football Clubs, was contract physiotherapist to some 40 other football clubs, and also organised the physiotherapists and masseurs to visiting teams at the 1956 Melbourne Olympics. As part of his work he began developing TENS units around 1951, and in 1971 began producing and marketing the 'Biostim' units — of which well over 50,000 have been sold. Biostim units were supplied to the Australia Games in 1986, and have been used for pain relief at every Olympic Games (except Moscow) since 1976. Mr Lamers' devices and treatment techniques were awarded a Bronze Medal at the 22nd International Inventions and New Techniques Exhibition in Geneva, 1994.

At my request, Mr Andrews sent me some literature on TENS/TNS and the use of small pulsed current for pain relief, and also on the various devices developed and marketed by Bio Electronics. This made very interesting reading, and it soon became clear that TENS/TNS is now widely accepted even in medical circles as a credible technique for treating both chronic and acute pain.

From reading the material about Bio Electronics' Biostim and Sportsmed devices, it also became apparent that they are also widely acknowledged as being well made, compact, efficient and nicely performing TENS/TNS devices — not just in Australia, but in many other countries as well.

What also attracted my interest, though, was mention of these same devices being suitable for CES use, in treating anxiety and stress. In fact Bio Electronics covers this application in a number of its publications, and even sells special ear-lobe electrode sets to go with its units, for this very purpose.

As it happens, a few days after receiving the envelope of literature from Mr Andrews, another parcel arrived from him — containing a sample of his firm's newer Sportsmed units. This was very nice, and certainly demonstrates the degree of confidence that Bio Electronics has in its products.

What this gesture has allowed me to do is try out one of these units, on both myself and other members of my family, and get a much better feel for their effectiveness in both treating muscular pain (TNS) and for anxiety/stress relief (CES).

As I write we're still in the process of trying it out, and I hope to provide a brief report on what we find soon. I'll also try to provide a bit more background on TENS/TNS, as well as give some comments and opinions on it, from some readers with a solid medical background. In the meantime, you might like to take a look at some of the product information and background on TENS/TNS provided on the Bio Electronics web site, at **http://www.bioelectronics.com.au**. It's quite informative.

Before closing this month, I'd like to thank Trevor Andrews and Bio Electronics for their willingness to help us explore this interesting aspect of electrotherapy. I don't know about you, but I find it a lot easier to accept the claims made for these TENS/TNS and CES devices — perhaps because they're generally not being claimed to effect 'miracle cures' of any serious ailments, just provide symptomatic relief.

Mind you, there also seems to be a lot more credible evidence suggesting that they actually work! ❖

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Serviceman

Even quite sophisticated gear can develop low-tech faults...

If there's a common theme running through this month's servicing stories, it's that basic low-tech faults can occur in almost every kind of electronics — even the most sophisticated scientific equipment. One of the stories involves such a piece of equipment, a gas chromatograph, while the others are about more familiar gear like handheld transceivers and hifi amplifiers.

We open the column with a story from an unexpected source — a member of that notorious Murphy clan. It arrived in the form of a letter from Tim Murphy, of Bean Creek in NSW. It began:

"You once said that you were waiting for the day when Murphy wrote an article for you. Well, here it is!"

(Actually I don't recall ever wishing for an article from Murphy, since he's caused me more than enough misery on the bench. I didn't want those sorrows transferred to my word-processor! However, *this* Murphy seems to be only distantly related to *that* Murphy, so I read on. This is what followed...

I am young and still very much a newcomer to the repair game. I feel that stories of simple repairs will encourage others like myself to 'avagoyamug', on the offchance that it is a simple enough fault for me to master. It is amazing how quickly one can learn doing this.

The first of my two stories I've called 'Speaker Now, or Forever Hold Your Pieces'. It began with a small request — "Tim, you know all about resistors and that sort of stuff don't you?" My reply was a non-committal "um...sometimes", meaning "What am I getting myself into now?"

A friend from up the road had a pair of Royce AUS100 UHF CBs, neither of which worked. Did I think I could fix them?

So the first thing was to see what they did, or didn't do in this case. A quick check showed one with no audio output, and the other with weak audio on transmit. Since a total failure of any sort is often easier to find than an obscure, partial failure, the dead receiver got looked at first.

Off came the covers, but there was nothing obvious; so I switched on. (A quick lesson I once learnt at another's expense was to never dismiss the obvious. One young friend had the works out of his radio trying to find the fuse shown in the circuit diagram. He didn't think to look on the back panel, did he?)

The most obvious check was to plug in an external speaker. Lo and behold, the radio worked. So — what's between the plug and the speaker, I wondered? The wires were intact, so that left only the little switch inside the socket.

A scratch and a clean didn't solve the problem, though. Gee willickers, there wasn't much left that could go wrong. Speakers don't break, do they?

Yes, it seems they do! I substituted an old speaker from a cassette player and we were up and running.

I can only think of two reasons for a failure in the speaker. It could have been a mechanical fracture, or it could have got a bit too hot and let go, from being run on full volume in a mobile environment.

Just in case it was the latter possibility, I added a small resistor to act as a fuse. It should reduce the current by a small amount, and will exceed its 1/4W rating as the speaker reaches its own maximum rating. The only real problem with this job was finding a speaker shallow enough to fit the confined space in the CB.

Radio No.2 will have to wait for another story though. Its fault is trickier, and I am having trouble finding a circuit for it.

My second story I've called 'Just a Little Problem!', and it goes like this...

I started getting reports that my FT23R (144MHz) handheld transceiver wasn't putting out any audio. The RF was full strength, but audio was weak to non-existent... sometimes!

I took up my screwdriver and removed the cover, but — oh dear! Murphy may be thought of as a mug, but this Murphy is not that big a mug. This was really TINY! I put it all back together and sent it off to the Yaesu distributor.

It eventually came back with the message that they couldn't find anything wrong. And it was working — at least until that afternoon, when I dropped it!

And so it sat there for a year or two, until I thought I had gained enough experience to have a fiddle myself. So I ordered the technical manual, but a certain shop lost my order three times, probably because its computer doesn't like my name!

Finally the manual arrived, so I pulled out the radio. But by this time the battery pack was dead. I used a fine hacksaw to open the case and found that dead cells were the problem allright. Still, it was not all a bad thing, since new batteries would double the rated capacity of the pack. Just a pity they were on back order...

I had a second battery pack that I had modified from a video camera, so I was still able to run the radio — at least something went right for me. (Incidentally that computer lost the order for the batteries, too!)

With the cover removed, I was reminded just how TINY it all was. It looked as though my soldering iron tip would cover half the board. Better get a small one, I thought.

From a little bit of homework I learned that this 'intermittent audio' fault is relatively common in these radios, and can be caused by anything from a dry joint to a faulty chip. Given the intermittent nature of the fault, I was hoping for the dry joint. I definitely did not want to have to unsolder something!

A little wriggling soon confirmed things, with the little microphone amplifier daughter board seeming to be at fault. The solder joints looked a bit suspect, so I added a little more solder and — Hey Presto! The problem was solved.

The daughter boards are soldered direct-

ly onto the mother board (from the back) and touching this up seems to have cured the problem. The microphone amplifier feeds the audio into the VCO unit and reduced output here will definitely cause weak audio on transmit...

My guess as to why it is a common fault is that while there is very little weight on the joins, the outside end of the daughter board is not supported and vibration plus heat gets to it after a while. (It sounds good in theory, anyway!)

So there you go. A very small repair job after all. The Father of Murphy says my head is out of all proportion to the size of the job, but then, it was my first really serious repair job. He also says I should tell you that Murphy didn't create the law, merely discovered it. So don't blame us too much!

OK Tim, I won't blame you or your immediate family. Just the same, if I were in your shoes I'd look into the prospects of changing my name to Smith, or something like that.

Seriously, though. I fully agree with you that simple stories like yours can provide an incentive for the novice serviceman. The difficulty that I face is in making them interesting enough to engage the attention of more experienced people. In this case, you have done it for me with your engaging, offbeat humour.

Now back to your stories. I can appreciate your surprise at finding a dud speaker, but open-circuit voice coils are not all that uncommon. They seem to show up most often in miniature equipment, such as your handhelds, or in hifi systems that are subjected to excessive volume levels.

And you were right on the ball with your suspicion of the speaker/phone socket. This is probably the most common cause of apparent speaker 'failure'. Socket switch failure is particularly common in small radios that are used with earphones. The constant operation of the switch causes either dirty contacts or loss of tension, both of which can stop the noise (sorry, 'music').

Little need be said about your second fault. Dry joints are the bane of our lives, and your uncle (thrice removed?) makes sure that they occur in the most awkward places.

Thanks for your stories, Tim. I hope you continue to have success with your future servicing exercises.

Hi-tech gear, but low tech fault

Now to our second contributor this month. He is Gerry Stanley, of Wahroonga in NSW, who happened to feature in this column last month. If you remember, it was Gerry who worked so long and hard to restore his old Telequipment CRO.

This month he is into something totally different. It's a repair to some scientific equipment, a gas chromatograph in fact. (We did use a story about this sort of gear some years ago and Gerry's tale adds to the information presented then. If this goes on we will all finish up as gas-chromatograph experts!)

Anyway, here's what Gerry has to say...

Let me begin by saying I'm not a technician or serviceman, I'm a retired food-flavour chemist. Even so, I did get some things to service that were more interesting than bunsen burners and test tubes.

In the mid-60s I joined the CSIRO Division of Food Research, where a small team was working at the forefront of the then-new techniques of Gas Chromatography and Mass Spectrometry.

The group had built a number of world class gas chromatographs, and these were giving good service at plants around the country. I had only been with the group a short time and was still finding my way about the systems when one of these units failed.

The team leader was busy on another job

at the time, so I was dispatched poste haste, AVO meter and circuit diagram in hand, to see if I could solve the problem.

The unit consisted of two parts, a large forced-draft oven and a standard 19-inch rack of electronic equipment about seven feet tall. It was all valve gear, of course. At the top of the rack was a large chart recorder, a monster of a thing in a heavy cast aluminium case. Below that was a pico-ammeter, capable of measuring currents from 10^{-5} amps down to 10^{-14} amps. This beautifully made instrument was used to measure the minute signals from the flame ionisation detector, an Australian invention and just the latest and best thing about at that time.

The next module down the rack was a temperature sensing and control unit. A platinum resistance thermometer formed one arm of an AC bridge and produced an out-of-balance current for the power controller for the oven.

This controller was a massive saturable-core auto transformer, housed at the very bottom of the rack and providing sufficient mass to prevent the whole shebang from tipping over.

I soon established that, as reported, the unit kept blowing one of its many fuses. The trouble was quickly narrowed down to the temperature sensing and control unit. Essentially, this was just an AC bridge and an amplifier to provide the necessary 60mA out-of-balance current to the power control unit.

When all the interconnecting leads were unplugged, the fuse still blew at switch-on — long before any of the valves had heated up and begun to draw current.

I was just contemplating this fact, and reckoning that it suggested either a faulty power transformer or a shorted filament supply, when the boss arrived to see how I was getting on.

I explained the situation and to my surprise he said "The fault's in the fuseholder!" He replaced the holder with a new one and to my embarrassment the system worked perfectly. The fuseholder was shorted to frame on the output side.

The same problem was to reappear many years later, with a second fuse in the same unit. Were there some crook fuseholders about at that time, I wonder?

So how about that? Who would have guessed such a simple fault, in such sophisticated equipment?

Just the same, I suspect that the boss had experienced those fuseholders going short circuit before. That is such an uncommon fault that it seems some prior knowledge would be necessary to spot it so quickly. So don't feel too badly about it, Gerry — and thanks for telling us the story.

Annoying noise

Now for our last story this month. It comes from Colin Golledge, of Mascot NSW, who you might remember told the story of a late night VCR alarm in a recent column. This time he is not being quite so frustrated in his search, but tells of a real fault that, without a touch of luck, could have been very hard to find...

I had recently been given a pair of Technics three-way 100 watt speakers, about 15 years old but still in perfect working order. I set these up in my workroom-come-study (my wife calls it the 'junk room'), as I had been wanting my own reasonable stereo system in there for ages. Now all I needed was an amplifier and tape deck!

So I got onto the telephone to my friend Kev, who lives on the other side of town (thank goodness, otherwise I think I would have half his house round here!) and asked if he had a spare amplifier I could borrow. After scratching his grey matter for some time, he said he did have a Pioneer amp in his basement but he didn't know whether it worked or not. Either way, I was welcome to keep it.

The Father of Murphy says my head is out of all proportion to the size of the job, but then, it was my first really serious repair job. He also says I should tell you that Murphy didn't create the law, merely discovered it...

Eventually I got the amp onto my workbench and before connecting it up I checked the fuses (five in all), then the output transistors to ensure they weren't shorted in any way.

They weren't, so I connected the speakers and tuner to the amp and 'Hey presto' it worked fine — except for a constant crackling in the right hand channel. I had to leave the room for a time and when I returned it was still crackling. It seemed Mr Murphy and his laws were on holiday for once! (Probably away visiting nephew Tim — Serviceman)

After some further examination, I came to the following conclusions:

1. The volume control made no difference to the crackling noise at all; therefore the fault was after the volume control;

2. No amount of banging the chassis or tapping the circuit board could make any change to the noise, so it wasn't an intermittent fault.

I then got out my old trustworthy oscilloscope, which has all of 1MHz bandwidth (but considering that I paid nothing for it, I'm not complaining!). Since I was only tracing an audio fault, this was more than adequate bandwidth.

I then physically felt all the transistors to see if any were hot (a sure sign that something was wrong), but no excessive heat was found.

I then started to trace the noise through the right channel, but I couldn't get the oscilloscope probe to the legs of one of the transistors, which was laying flat on the PCB. I bent it up into a more accessible position and the noise suddenly stopped!

I waited a while and it remained quiet; so I then pushed the transistor down and the noise started again. I checked underneath the transistor for bad joints and even resoldered its legs, but this made no difference.

With a small inspection mirror I checked that there was no contamination on the body of the transistor. The Serviceman had once described a similar problem, caused by contaminates sticking underneath the body during manufacture.

There seemed to be no such problem in this case, so I can only assume that the fault lies inside the transistor and is probably a loose or broken lead.

So I was faced with replacing the transistor, but had nothing suitable in the bits-box. And since it would be some time before I could go to town to get a new one, I bent the transistor up into its noise-free state and there it has stayed to this day! (Read "I saved 50c!")

Well, Colin, your fee for this little story will buy you more than one new transistor for your amplifier. Please complete the job and replace the faulty transistor as soon as possible!

Like you, I wonder what kind of fault could cause the problem. Most noisy transistors exhibit the fault in any physical position, it being most commonly a heat sensitive condition. I guess it must have been an intermittent open circuit inside the transistor and in the upright position, gravity was holding the circuit closed.

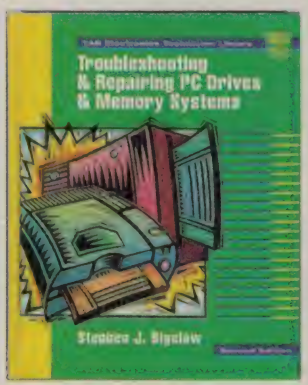
And I wish *I* could afford the luxury of leaving a faulty part in circuit, even in my own personal gear. With my luck the amplifier would have been back on the bench within the day!

Thanks for that story Colin, and can we look forward to more stories in future? ❖

New Books

Computer servicing

TROUBLESHOOTING & REPAIRING PC DRIVES & MEMORY SYSTEMS, second edition, by Stephen J. Bigelow. Published by McGraw-Hill, 1998. Hard cover, 244 x 192mm, 376 pages. ISBN 0-07-006384-2. RRP $157.95 (Soft cover $62.95)



Business may have slowed down in the TV and VCR servicing industry, due to the high reliability of modern equipment, but new areas of opportunity have opened up with personal computers. There are now zillions of 'em out there, and they're scarcely renowned for their reliability. For the service tech prepared to learn about the technology, they could easily be the key to survival.

This volume in McGraw-Hill's TAB Electronics Technician Library focusses on disk drives and memory systems. It majors on memories (SIMMs, etc) and on floppy and hard disk drives, but there's also information on tape drives, PC cards, CD-ROM drives and 'others' like Iomega's Zip, Bernoulli and Ditto, and Syquest's drives.

It's quite comprehensive, with an introductory section covering basic PC system architecture followed by other sections dealing with test instruments, tools and diagnostic software, and other servicing basics. Then in turn there are meaty chapters on solid state memory devices, floppy drives, hard drives, PC cards, tape drives, CD-ROM and DVD drives, and finally the 'other' drives.

In each case there's a surprising amount of good solid reference information (interface connections, basic system operation, performance standards, etc), with descriptions of typical adjustment procedures, and detailed troubleshooting guides.

It's all very practical and down to earth — and also quite up to date, in most areas. There's nothing on CD-R or CD-RW drives, and the coverage of DVDs is little more than a token; but these are all quite new, and I daresay you won't find much in any book at this stage.

Overall my impression is that Mr Bigelow has done an excellent job, and his book will be of great value to anyone who needs to carry out efficient and effective troubleshooting/repair on today's PCs. The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. (J.R.)

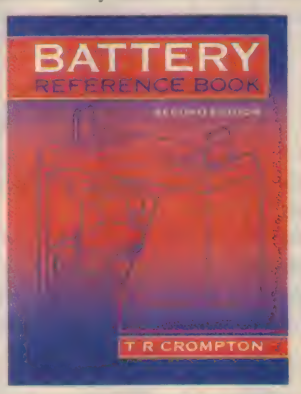
Battery reference

BATTERY REFERENCE BOOK, second edition, by T. R. Crompton. Published by Butterworth Heinemann, 1995. Soft cover, 186 x 244mm, 650 pages. ISBN 0-7506-2567-8. RRP $125.

This is a remarkable book, in that it describes in excellent detail almost every type of battery currently available. And there are hundreds of them. It's therefore quite large, and broken into six parts.

Although aimed nominally at engineers, it should be found useful by almost anyone into batteries. It's full of technical information that includes the characteristics of each type of battery technology, lots of diagrams showing construction techniques, graphs showing charge and discharge characteristics, and tables that present important data about a particular battery.

Much of the information is from UK or USA based battery manufacturers, so there's



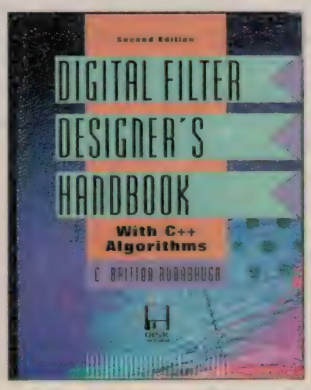
no reference to Japanese manufacturers such as Panasonic. This is quite an omission, as it therefore doesn't include the NiMH (nickel metal hydride) battery — one of today's most popular battery technologies.

The contents cover electrochemical theory as it applies to batteries, battery selection, theory, design, applications and charging methods. Unfortunately there are no charging details for all the secondary cells it describes, such as the lithium-vanadium pentoxide type. The appendices include a comprehensive bibliography and a glossary.

The book is well illustrated, and in the opinion of this reviewer is excellent value. It has a lot of information that should prove useful to anyone working with batteries. The review copy came from Butterworth Heinemann, PO Box 146, Port Melbourne 3207. (P.P.)

Digital filters

DIGITAL FILTER DESIGNER'S HANDBOOK, second edition with C++ algorithms, by C. Britton Rorabaugh. Published by McGraw-Hill, 1997. Hard cover, 244 x 195mm, 479 pages. ISBN 0-07-053806-9. RRP $140.



Apparently the first edition of this book was very popular, encouraging the author and publisher to follow up with this expanded and enhanced second edition. Most of the accompanying software (supplied on a 3.5" floppy) has been rewritten in object-oriented C++, for example.

It's basically a very comprehensive reference book on the operation and design of digital filters — those successors to traditional analog filters, which are even more arcane and heavy-going, for most of us. Author Rorabaugh starts off with signal and spectra basics, noise and filter fundamentals, and then moves methodically through Butterworth, Chebyshev, elliptical and Bessel filter basics before introducing digital signal processing, the DFT, the z transform and FFTs. He then progresses to introduce FIR and IIR digital filters, and then cover the design of these in detail.

It's very thorough, and should be of great value to any engineer involved in digital filter design — and also as a reference for later-year engineering undergraduates. However the claim that it will also be of value to hobbyists (made in both the author's preface and on the outside back cover) is a bit over-optimistic; there's a lot of fairly heavy duty maths involved, which would lose most hobbyists in short order. The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. (J.R.) ❖

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

LCD DPM input isolation circuit

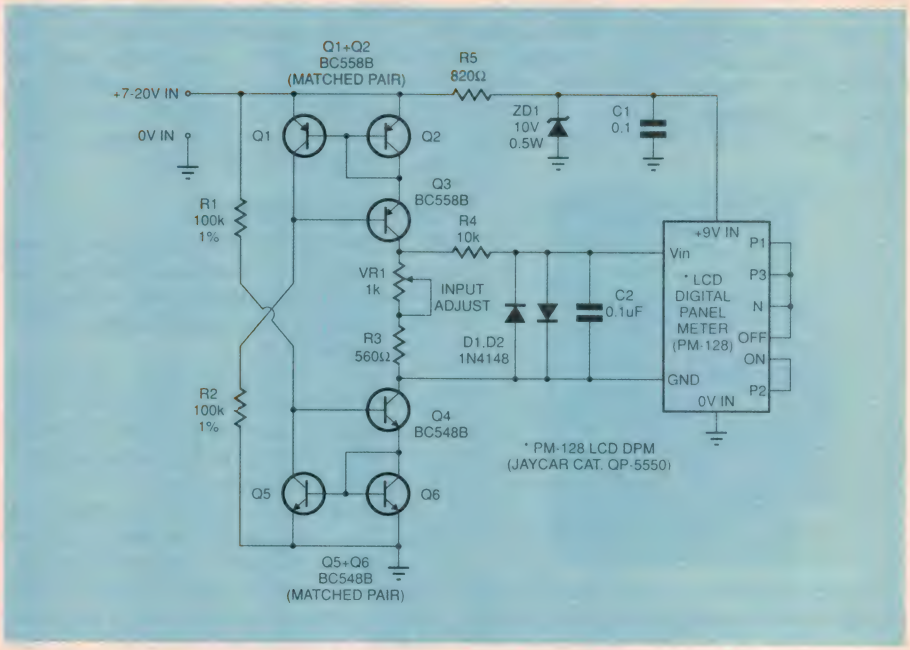
THIS MONTH'S WINNER!

On a recent project I had the need to use a PM-128 LCD digital panel meter, (Jaycar Cat. No. QP-5550), to monitor its own supply voltage. In the past, it has been usual to use a DC-DC converter to isolate the DPM's supply voltage or an expensive precision op-amp to isolate the input voltage.

This circuit takes a different approach, employing complementary current mirrors to set up a floating, divided input for the DPM. R1 and R2 set the input current level, which is mirrored through VR1 and R3, developing a voltage equal to Vin/100 when correctly adjusted. This voltage is free to float to the reference level required by the DPM (approx. 6.2V). D1 and D2 provide a degree of overvoltage protection.

For best performance the Q1/Q2 and Q5/Q6 pairs should be matched if possible. Also, the components should be mounted close together on the PCB, away from heat sources and draughts. For even better accuracy, each matching pair of transistors can be glued together and covered with a piece of heatshrink tubing.

During set-up, the input adjust pot VR1 should be positioned at mid-travel and then adjusted for maximum accuracy in the middle of the typical measurement range.



The overall accuracy of this circuit is not exceptional, but it is suitable for car battery voltage monitoring and other applications where measurement over a limited range is required. If the circuit is adjusted for zero error at 13.0V, it will remain within approximately 0.1V of the true reading between 11V and 15V.

Steve Carroll,
Timmsvale, NSW **$35**

Driveway detector using pneumatics

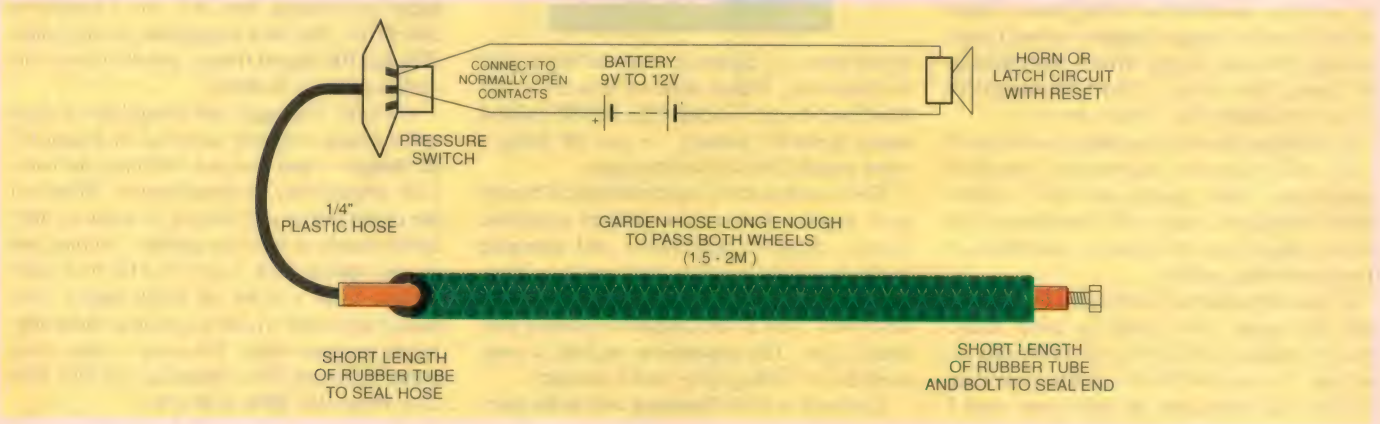
This one is simple, crude but effective. While not terribly electronic, it's a system of detecting the passage of vehicles. It is quite robust, and could detect anything from motorcycles to farm machinery.

First, you will need to get hold of a washing machine or dishwasher level detector, which is really a low pressure diaphragm switch. You'll also need several metres of garden hose (long enough to pass under both wheels) and around 2 - 3 metres of 1/4" plastic tubing.

Depending on the internal diameter of the hosepipe, you may need a few other odds and ends to seal one end off entirely. (I used a 1/4" bolt and a couple of inches of rubber tubing.) The other end of the hose connects to the pressure switch via the 1/4" tubing, and I found that a bit of rubber tubing and a hose clamp worked well to give an airtight seal.

The rest of the circuit is trivial, and is simply wired across the normally open contacts of the switch.

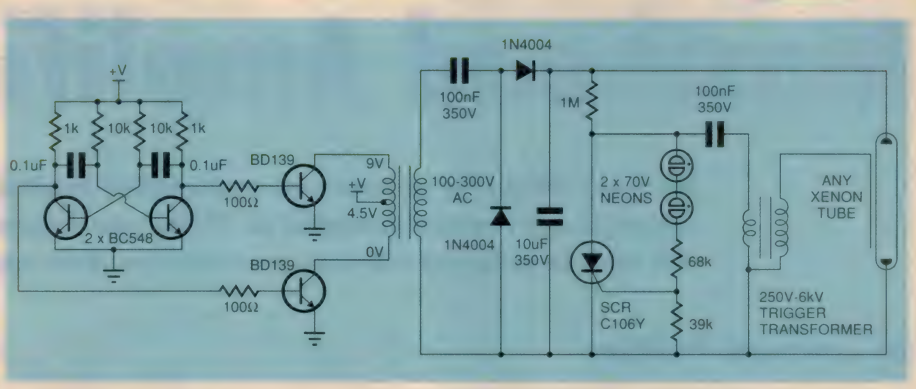
David Francis
Cannonvale, Qld **$25**



As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a complete closed circuit TV system, comprising a 5" B&W video monitor, CCD video camera with stand, power supply and cabling. This system comes from our sponsor Allthings Sales & Services, and is valued at $369.00!

Win our 'IDEA OF THE MONTH' Prize!

3V xenon strobe



This circuit runs from 3V up to about 15V, and generates between 130 and 300V AC. The oscillator runs at a fairly high frequency, with the power transistors alternatively driving each half of the transformer. I found this to be the most efficient method, as each alternation will create an equal but opposite magnetic force in the coil.

I found that the induced voltage at the secondary will get up to 140V with a 3V supply, and over 220V at 12V. (It will drive a 6W fluorescent light quite happily from 6V.) The circuit draws 300mA when driving the xenon strobe from 6V. The circuit draws more current with a higher supply voltage, taking over an amp when driving the xenon strobe with a 1uF storage capacitor.

The xenon strobe circuit goes very well with the inverter, and will flash at around 1Hz, depending on the value of the storage capacitor and the input voltage. The voltage doubler slowly charges the storage capacitor, and when there is enough voltage across the trigger capacitor the neons will conduct, causing the SCR to fire. This pulses the tube with about 6kV from the trigger transformer which ionizes the tube, causing it to flash and discharge the storage capacitor at the same time. If you add more neons, the flash will be brighter and slower, but a higher input voltage may be needed. This circuit would make a great tail light for a bicycle, as it will run off 3V without any problems and it is fairly compact.

Michael Jackson
Newmarket, Qld. **$30**

DIY keypad for microprocessors

Here is a method of construction for a keypad suitable for use with microprocessors and other digital projects. The assembly is only 7mm thick, so it is suitable for handheld devices as well.

The first task is to design the keyboard layout; this would generally be a rectangular array, and I would recommend at least 15mm between centres for each of the switches. Each 'button' is located within a circle of 15mm diameter, so that an 8 x 4 array would result in a 120 x 60mm panel. The switching elements are zippy switches (the style used in many remote controls), which are momentary action PCB mounting and cheap.

Next, design a PCB to mount the switches and interconnect them into the required matrix. The PCB size should be at least 10mm larger in both dimensions than the panel cutout, to leave a 5mm border for the mounting screws. The zippy switches are not mounted in the conventional way; instead, an 8mm hole is drilled in the PCB for each switch, and they are then mounted 'toad-in-a-hole' fashion by splaying their leads and soldering such that the body of the switch projects through to the non-copper side of the PCB. In this way the switch actuator will be 2-2.5mm above the surface of the PCB.

Now cut a piece of 3mm acrylic sheet the same size as the PCB, and drill it with 13-14mm holes on the same centres as the PCB holes. This forms the 'finger guard' and is epoxied onto the non-copper side of the PCB.

The legend overlay for the keyboard is paper — many hobbyists own or have access to a PC with a laser or colour inkjet printer, and this is used to design the legends for the keypad — your imagination is the limit here! Any other means of putting marks on paper may be used with equal effect.

From a sheet of 1.6mm thick transparent silicone rubber, cut a piece the same size as the PCB. The paper artwork, cut to size, is glued to the rubber sheet face-down using translucent silicone sealant. This should be applied using a flat blade to the back of the rubber then, when the artwork is in-place and aligned, more is applied to the back of the artwork for added protection.

When the adhesives are cured you should be able to construct a 'sandwich': PCB, acrylic, artwork, rubber and panel. The sandwich is permanently assembled by drilling 2.5mm holes around the border and fixing with M2.5 bolts. The switches are actuated by pressing on the silicone sheet — It deforms, allowing your finger to actuate the switch. It has a nice tactile feel since the zippy switches click when pressed.

Silicone rubber sheet may be obtained from Clark Rubber and other rubber suppliers — it is expensive, but you only need a small amount. Note that when drilling the mounting bolt holes, do not drill the rubber. Instead, use a punch or sharp blade. Also, drilling large holes in thin acrylic can be difficult, but don't worry if it chips or cracks a bit, since it is completely hidden by the overlay.

I have used this design successfully for some time. It is surprisingly durable, easy to clean, and can even be made watertight. With a little ingenuity, it is also possible to mount LED displays under the protective surface.

I am happy to field questions and comments: email me at **hardy@sweng.stortek.com**.

Stephen J. Hardy
Latham, ACT **$30** ❖

Construction Project

Improved VHF-UHF Masthead Amplifier

Here's a design for an improved and updated masthead amplifier, to boost signal strength and improve reception of TV and other signals in the VHF and UHF bands. It's not hard to build and will cost you much less than commercially available units.

by Andrew Palmer

For good TV and FM reception, your receiver needs signals that are as strong as possible compared with atmospheric noise and the noise that is inevitably generated inside the receiver's own 'front end'. Otherwise, in striving to amplify the weak signals, the receiver will have to amplify the front-end noise to the point where it will become evident on your TV picture as 'snow', and/or audible as 'hash' in your FM stereo program.

There are various kinds of situation where achieving a satisfactory signal-to-noise ratio can be a problem, but three of the most typical are as follows:

1. You are in a 'fringe area' with respect to the reception of the signals concerned, making it difficult to achieve sufficient signal strength — even with a large and elaborate antenna system.
2. You are in a reasonable signal area, but it isn't feasible to use an antenna system capable of producing the strongest possible signals, and your TV or FM receiver is a little elderly. Although too good to throw away, its RF front end has a fairly high noise level — enough to cause an obvious deterioration in reception.
3. You are in a reasonable signal area and your antenna is producing fairly strong signals, but you need to feed a number of sets in various rooms of the house. After passing through the necessary splitters and cable runs, with their inevitable losses, the signal levels reaching the receiver(s) are not strong enough.

In all of these common situations, reception can generally be improved quite noticeably by fitting a wideband RF preamplifier, preferably at the top of the antenna mast. In other words, a 'masthead amplifier'.

But why should it be at the top of the mast? Basically, because this allows it to amplify the signals picked up by the antenna *before* they suffer from any attenuation or other deterioration due to the cable and things like splitters.

The amplifier itself is housed in a length of 32mm OD PVC tubing, with close-fitting end caps (front). The matching power feed unit is in the small utility box at rear, which connects at the foot of the co-axial downlead.

Fairly obviously, the masthead preamp can't improve the basic ratio between signals and noise as picked up by your antenna. In fact it will inevitably make things slightly worse, by contributing some extra noise of its own. But by placing it as near to the antenna as possible, we maximise the ratio between received signal strength and amplifier noise, and at the same time boost the strength of the signals to be pumped down the cable. Any attenuation introduced by the cable system will therefore affect both the amplified signal and amplifier noise equally, without affecting the ratio between them.

With the alternative approach of fitting an amplifier down at the receiver end of the cable, the signals will already have suffered some attenuation by the time they reach it.

This will immediately provide a poorer ratio between the signal at the input to the amplifier, and its own inherent noise — preventing it from giving as much improvement.

By the way, although a masthead amplifier inevitably contributes some noise of its own, this is quite small and typically rather less than that added by the tuner section of a TV receiver — particularly if the receiver is not one of the latest models. And of course fitting it to the top of the mast allows it to operate on the signals at the most favourable point.

So if you're in a fringe area, or have a less-than-ideal antenna system with a slightly older receiver, or need to feed the signals through quite a few splitters and cables, a masthead amplifier could well give you noticeably better reception.

The flip side

Does a masthead amp have any drawbacks? Certainly. Because they're a wideband amplifier, handling all the channels together, a really strong signal on one channel can cause amplifier overload and produce interference with the other channels. So a masthead amp is *not* likely to be of much benefit if you're in a strong signal area, or where you have one really strong local signal and you're trying to improve the reception of much weaker signals. Unless you take special steps to prevent the strong signal from overloading the amplifier, it could well make things *worse* rather than better.

The same tends to apply where you have a strong local VHF signal from a primary transmitter, and some weaker UHF signals from translators.

Of course a masthead amplifier can't in itself do much with other kinds of reception problems, either — like 'ghosting', which is caused by multiple versions of the same signal reaching the antenna via different paths. With this kind of problem, all the amplifier might let you do is swing the antenna around to a position which minimises the ghosting, making up for the reduction in wanted signal strength with its additional gain.

A masthead amplifier isn't a universal cure-all, then, although it can improve reception in a lot of situations.

About masthead amps

There have been quite a few designs published for VHF-UHF masthead amplifiers, in various magazines. I described the last one published in *EA*, in the December 1988 issue. Like earlier designs it was based on the OM350, a hybrid VHF/UHF wideband amplifier IC manufactured by Philips Components. However this device is no longer being made, it seems, and even before this happened it had become quite expensive. It's therefore been necessary to revamp the design using a newer, cheaper and readily available device.

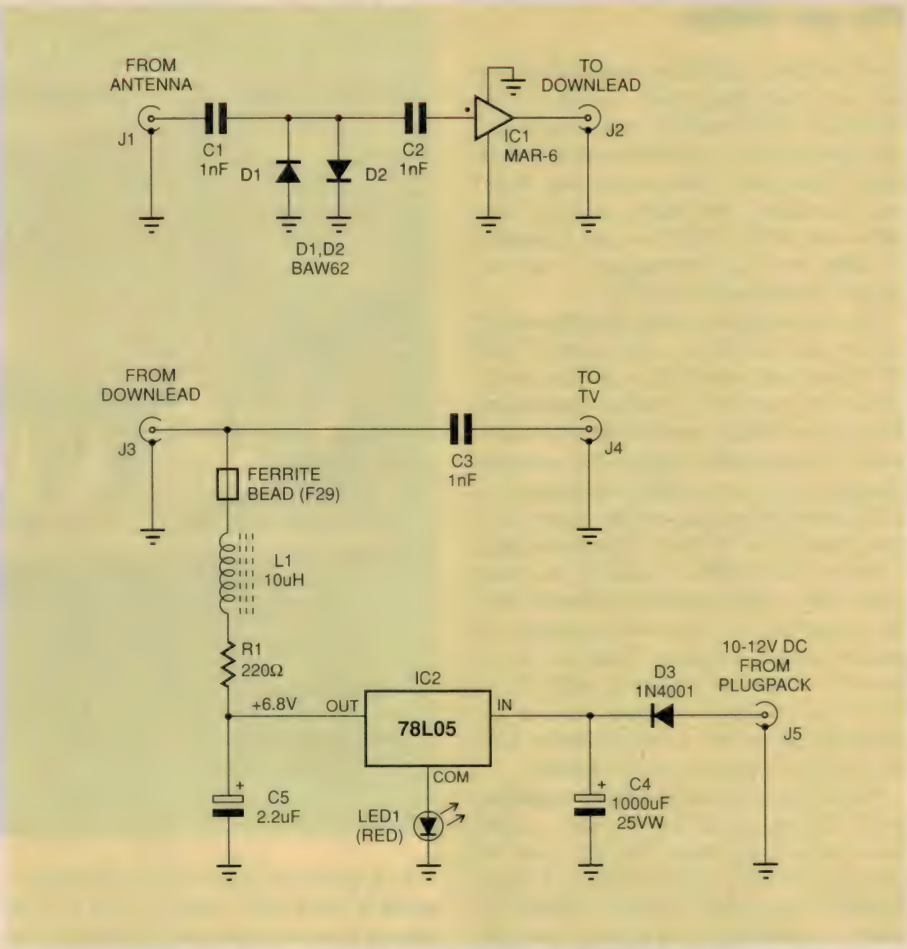


Fig.1: As you can see, the new amplifier is very straightforward. A Mini Circuits MAR-6 chip provides the wideband amplification (top), while the power feed circuitry is based on a 78L05 regulator.

The amplifier I've chosen is the MAR-6, made by New York based firm Mini-Circuits and available in Australia from Clarke & Servern Electronics. The MAR-6 is an excellent wideband amplifier, providing stable amplification of at least 9dB up to 2GHz, combined with a low noise figure (about 3dB).

Incidentally, *noise figure* is a measure of the noise introduced by the amplifier itself. It is actually the ratio of *input* signal-to-noise ratio to *output* signal-to-noise ratio, so that the lower the noise figure the better. An ideal amplifier would inject no additional noise of its own, so that the ratio between input and output signal-to-noise ratio would be unity or 0dB.

The UHF tuners in many older TV receivers typically have a noise figure of somewhere between 11 and 14dB, so that the 3dB figure of the MAR-6 is obviously rather better. Since the overall noise performance of a receiving system is determined almost entirely by the noise figure of its input circuitry, this gives the MAR-6 the potential to give quite a significant improvement when used 'up front' in a masthead amplifier.

The MAR-6 comes in a very small cylindrical package, about 2mm in diameter and 2mm high. It's fitted with four radial leads at 90° (two of which are earthed), and is basically a two-transistor amplifier with untuned and low value loads in order to achieve the required wide bandwidth and be capable of driving a co-axial cable.

Because the MAR-6 is designed to receive its power via the signal output pin, it's very suitable for use as a masthead amplifier. It requires about 3.5V DC, at a working current of around 16mA.

Mini-Circuits recommends that the MAR-6 should be mounted on a small double-sided PC board, and gives a suggested layout. Although superficially there's not much involved in using the device in this kind of application, it's actually a good deal more critical than you'd think. At UHF, an extra millimetre of lead length or PCB pattern can resonate with stray capacitance, to produce quite significant changes in gain at certain frequencies. Similarly even short lengths of signal path which do not maintain the correct characteristic impedance level can produce mismatch reflections, setting up standing waves and again producing undesirable peaks and notches.

The new design

To avoid these pitfalls, the design described here has been based fairly closely on the December 1988 amplifier, which was originally developed by the R&D people at Dick Smith Electronics. That design was tested very thoroughly, and turned out to be very stable and reliable. All I've done, basically, is adapt the same techniques to use the MAR-6 instead of the OM-350.

The actual circuit is quite straightforward, as you can see (Fig.1). The MAR-6 itself (IC1) forms the heart of the masthead amplifier proper, with the only other components being a pair of high-speed diodes D1-D2 to protect its input from damage due to corona discharge, etc, and coupling capacitors C1-C2 to block DC and prevent the diodes from disturbing by the MAR-6's internal biasing.

Power to the MAR-6 is sent up the co-ax cable from a small matching feed unit. Here the amplified RF from the amplifier is passed through blocking capacitor C3 to your TV receiver or whatever, while DC is fed to the amplifier via shunt inductor L1 and load resistor R1. A ferrite bead is used on one of L1's leads to ensure stability.

The DC power is derived from a standard 9-12V DC plug pack supply, with a small three-terminal regulator chip IC2 used to provide smoothing and regulation. A small red LED is connected in series with the regulator's common lead, and serves two purposes: it both acts as a pilot light, and also 'bootstraps' the regulator so that its output becomes just under 7V. This ensures that the working voltage at the MAR-6 is very close to 3.5V, at its nominal current of 16mA.

Series diode D3 is used to prevent damage to the regulator if the plug-pack polarity is accidentally reversed.

As you can see there's nothing terribly different about the new design in terms of its circuit. It's in the area of physical layout that it differs, particularly for the masthead unit itself. Great care has been taken to minimise excess lead lengths, and reduce any discontinuities in terms of characteristic impedance.

As with the 1988 design a double-sided PCB is used, with the copper on one side used as a 'ground plane'. The MAR-6, diodes and input capacitors are all mounted on the copper track side, to allow the shortest possible lead lengths. A hole 2mm in diameter is drilled in the board where the MAR-6 is fitted, to allow it to be mounted with its leads flush with the copper surface.

This approach allows the main RF signal tracks to function as microstriplines of the correct impedance, to provide fewer discontinuities in the signal path. Note that the amplifier PCB has been designed to allow C1 and C2 to be either SMT devices, or standard small disc ceramics with their leads cut very short.

Inside the power feed unit, all of the smaller components are on a small double-sided PCB supported by the two Belling-Lee type coax sockets. Note that when this photo was taken, a 150-ohm resistor was fitted for R1 — the final value is 220 ohms.

To improve the performance still further, the PCB has a large 'notch' at each end, so that the co-ax connectors mount directly to it in axial fashion, again with minimum disturbance to the characteristic impedance in the signal path. The outer earthed sleeves of the sockets can also be bonded directly to the ground plane copper on each side of the board, for minimum inductance.

And finally, to make sure that the 'ground' copper on both sides of the PCB does indeed provide a true unipotential ground, the two are bonded firmly along both sides by lengths of copper shim soldered full length.

All of these steps have produced a design that although not exactly pretty, is straightforward and quite easy to reproduce, and provides a consistent high order of performance.

The board is designed to be housed in a 145mm length of 32mm OD PVC electrical conduit, with matching tightly fitted end caps to keep it waterproof. The idea is that the input and output co-ax cables pass through close-fitting holes in the end caps, and then terminate in plugs which mate with the sockets on the PCB. The complete assembly can then be put together inside the PVC tube, with 'Silastic' or similar sealant around the cable entry holes and the end cap edges. A strap clip can then be used to mount the amplifier on the mast, near the antenna terminals.

The power feed unit is housed in a small 'UB5' size utility box, measuring 83 x 54 x 28mm. As there are a few more components in this unit compared with the 1988 design, I have designed a second small PCB to make it easier to assemble.

The power board is again double sided, with one side used largely as a ground plane. The board is again notched to take the co-ax connectors, although as you can see here they're both on one longer side so the PCB can be supported by the connectors when they're mounted on the case front panel. Again the body of the connectors is soldered to the earth copper on both sides, and as the board is very small and light, this gives it more than adequate support.

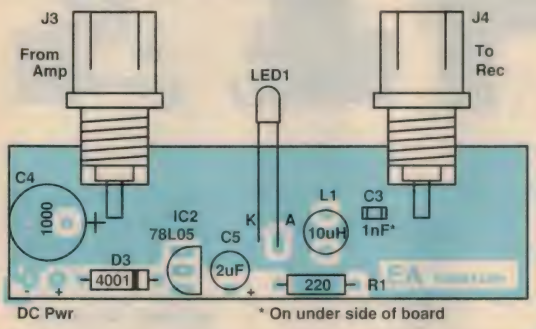
All components except the DC blocking capacitor mount on the 'top' of the board, with C3 mounted on the track side to again minimise its lead length. As before you can use either an SMT component for C3, or a small disc ceramic with its leads cut as short as possible.

Construction

The most critical part of the project is the actual masthead amplifier assembly, of course. But this needn't present any problems, provided that you tackle it in a logical fashion.

First cut the copper shim into two strips 67mm long by 15mm wide. Crease these down the centre, and bend them around the edges of the PCB so that they lie flat on the copper of both sides. Then solder both of them carefully along the full length of both sides, so that they each bond the two copper

Above is a view of the track/components side of the amplifier PCB, showing just about everything. It isn't pretty, but this construction gives stable amplification.



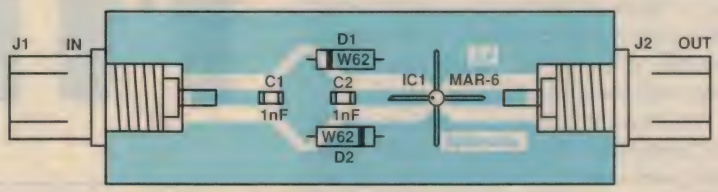


Fig.3 (left) shows the overlay for the power feed PCB, while Fig.2 (above) shows the amplifier PCB.

laminates together.

Next take the two Belling-Lee sockets, and solder them carefully into the appropriate cutouts at the ends of the PCB. Take care to position them with the centre (insulated) spigot just resting on the central stripline track, so that it won't be moved out of position during the soldering. Note that the outer sleeves of the sockets should be soldered to the adjacent 'ground-plane' copper along *both* sides of the sockets themselves, and on both sides of the PCB as well.

With all of this 'heavy' soldering done, you can now solder in the two diodes D1 and D2. These mount on the track side, but the PCB has 1mm holes to allow you to locate the diode leads by bending them down at 90°. After soldering carefully, the excess leads are cut off flush on the underside of the board.

Input coupling capacitors C1 and C2 can then be fitted. If you're using SMT parts for these, they're placed carefully over the small track gaps and soldered first at one end and then at the other, holding the body down with a toothpick or similar and making the joints as quickly as possible to avoid overheating the component.

If you're using standard disc ceramics, as shown in the photo, the idea is to trim their leads as short as possible, while still providing *just enough* exposed metal for soldering to the PCB tracks (say 1.5 to 2mm at most). Then you do the actual soldering as quickly as possible, so that the components are again not damaged.

The final step is to fit the MAR-6 amplifier. If you examine this closely, you'll find that it has a small white dot on the top, near one of the four leads. The lead concerned is also cut on the end diagonally, whereas the others have a double chamfer. This lead is the input lead, and the MAR-6 must be fitted with this lead soldering to the signal track from C2. The overlay diagram should make this clear.

As with the other components solder the four leads of the MAR-6 quickly and carefully, to avoid overheating it.

Assembly of the power feed unit is little more involved than with the previous design, but again not difficult if you tackle things in the right order. The first step is to drill and ream out the holes in the front panel for the sockets and LED, using a photocopy or tracing of the front panel artwork as a template. Then you can carefully stick on the Dynamark dress panel and mount the sockets (the LED comes later).

Most of the smaller components can now be mounted on the PCB, although reservoir capacitor C4 and the LED are not fitted as yet. But you can fit R1, L1 (with the ferrite bead on its 'uppermost' lead), C5, D3 and IC2 to the top of the board — in that order, I suggest — and then C3 to the underside.

Although the LED isn't fitted as yet, you should fit a pair of PCB terminal pins to the two pads concerned. This will allow the LED to be added much more easily later. Two further terminal pins can be fitted at the lower left-hand corner of the board, for the

PARTS LIST

Resistors

R1	220 ohms 1/4W carbon.

Capacitors

C1,2,3	1nF ceramic (disc or SMT)
C4	1000uF 25VW RB electrolytic
C5	2.2uF 35VW TAG tantalum

Semiconductors

D1,2	BAW62 diode
D3	1N4001 or similar power diode
LED1	3mm red LED
IC1	MAR-6 wideband amplifier
IC2	78L05 regulator (TO-92)

Miscellaneous

L1 10uH RF inductor

Plastic utility box, 83 x 54 x 28mm; 145mm length of 32mm (OD) PVC conduit, with two end caps to suit; two PC boards one 71 x 25mm coded 98MHA5A, the other 69 x 20mm and coded 98MHA5B; four co-axial sockets, Belling-Lee single hole panel mount type; one 2.5mm power socket, panel mount type; four PCB terminal pins; one ferrite bead, F29 material; length of copper shim, 70 x 30mm; dress front panel for utility box; 80mm length of two-core cable; machine screws and nuts, etc.

wires from the DC input socket.

With these components all fitted, you should now be able to offer up the PCB assembly to the back of the RF sockets, and proceed with soldering the two together. Before doing so, though, you may need to trim-file the notches to allow everything to fit together.

As you can see, the board is mounted so that the insulated socket spigots solder to the signal tracks on the PCB, while the socket bodies solder to the surrounding copper on both sides, as before.

When this is done, the remaining steps are to fit revervoir electro C4 and the LED. The electro is fitted in the usual way, as you can see, while the LED is fitted with its body protruding through the hole in the front panel and its leads soldered to the tops of the terminal pins you fitted before. Make sure you orientate it so that the longer anode lead mates with the terminal pin nearest L1.

You may want to apply a small amount of glue around the LED body at the rear of the front panel, to ensure it's held firmly in place.

The final step is to use a short length (say 80mm) of two-conductor cable, to connect the board's DC input pins to the lugs of the power input connector. Make sure that you fit these so that the positive side of the incoming DC connects to the pin marked '+' on the PCB overlay diagram (the one nearer D3).

Testing & installation

When both units are finished in the electrical sense, I suggest that you first connect the power feed unit to your plug-pack supply, and do a quick check to ensure that everything is in order — before connecting it to the amplifier unit. With power applied, the LED should glow reassuringly and you should be able to measure about 6.8 - 7V DC at the end of R1 nearer IC2 and C5 (with respect to the earthy side of the RF sockets). You should also get virtually the same reading at the insulated pin of the 'amplifier' socket.

If the LED doesn't glow and you get no voltage reading, chances are that you've wired the DC input with reverse polarity. On the other hand if the LED doesn't glow but there's almost the full plug-pack voltage present at R1, you've almost certainly wired the LED in backwards. In either case, it shouldn't take long to fix the mistake.

Once everything seems OK, try connecting the amplifier and power feed boards temporarily together via a short length of co-ax, and try them out to make sure everything is working correctly. It's better to do this *before* you fit the amplifier unit into its protective tube, and mount it up on the mast!

First check the DC voltage at the centre spigot of the 'amplifier' socket. If all is well it should read very close to 3.5V. Then try hooking the combination of units temporarily into the antenna lead, right at the receiver, so that you can use the receiver to check that they're working. With power supplied the signals fed to the receiver should be noticeably stronger via the amplifier setup than with direct input from the antenna. (The noise will also be stronger, with this temporary setup.)

If all seems well, you're now ready to fit the amplifier unit into its housing and instal it up on the masthead.

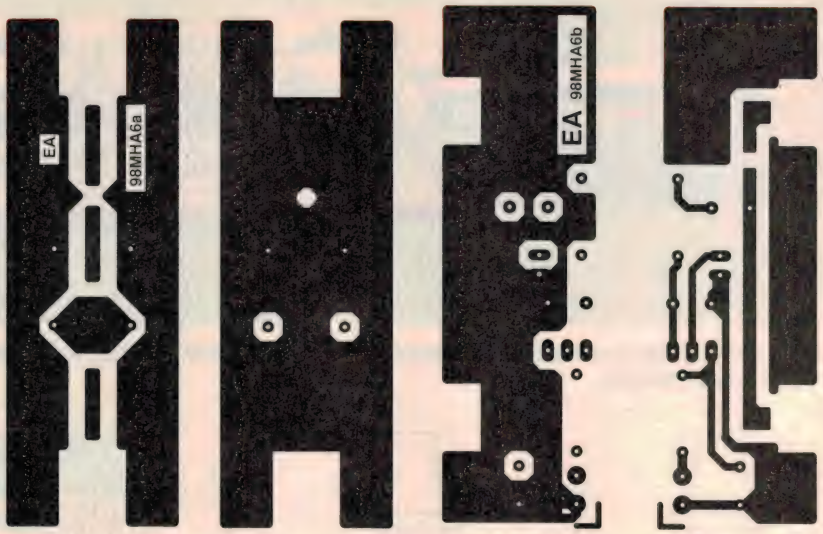
The procedure here is to first drill a hole in the centre of each of the PVC end caps, just large enough to take the co-ax cable snugly. Then you'll need to cut the antenna downlead, say 30cm or so from the antenna end, and poke each of the two cable ends through a cap (from outside to inside).

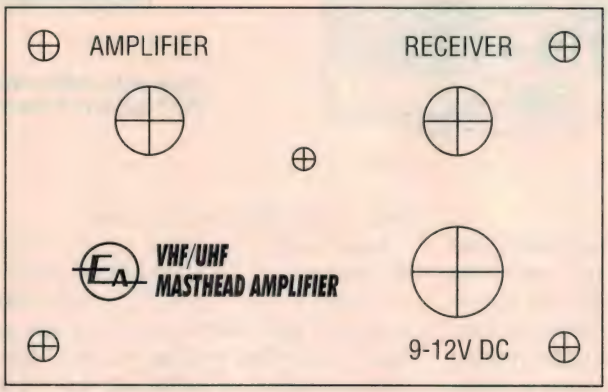
This done, you then fit a Belling-Lee type co-ax plug to each one, soldering the connections carefully if they're of the solder type. The PVC tube is then slipped over the amplifier board, and the plugs fitted into the appropriate socket at each end of the board to complete the connections. After this the end caps can be slid along the cables and over the ends of the PVC tube, to complete the housing and hold everything together. The length of the tube is carefully set so that when the caps are fully on, they will hold the co-ax plugs quite firmly in the amplifier sockets.

The final step is to add fillets of 'Silastic' or similar sealant around the cable entry points and the edges of the caps, to seal the complete unit and keep out moisture. It would be a good idea to add a dollop of the same sealant to the antenna end of the short input cable, to prevent moisture from seeping down inside the co-ax.

Needless to say the amplifier unit is mounted up on the mast near the antenna terminals, using a strap clip around the outside. The power feed unit is located down at the receiver end of the cable for a single-cable system, or just before the first splitter unit if you have a multiple-set situation.

That's about it. There's nothing to adjust — just hook it all up, apply the DC power to the feed unit and away it goes. ❖





Above: The artwork for the amplifier and power feed PCBs, actual size and showing both sides of each. At left is the artwork for the power feed unit front panel, also actual size.

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THIS KIT INCLUDES THE SAME TOOL AS THE TS-1200 WITH THE FOLLOWING ADDITIONS:
•Quality plastic case •Stand •Flame tip •Hot blow tip •Deflector for hot blow tip •Hot knife tip •Cleaning sponge •2 metal storage trays for hot tips •Cap and 2.4mm solder tip. Cat. TS-1205

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These LEDs are so bright, its hard to believe they are LEDs. All are 5mm and are water clear.

New in 98

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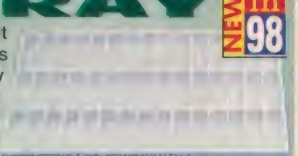
Green	6000	3.5	ZD-1774	$12.95
White	3000	3.5	ZD-1775	$12.95
Blue	3000	3.5	ZD-1776	$12.95

CAPACITOR STORAGE TRAY

New in 98



This unit matches our very popular resistor storage tray. It is the same physical size, but has 45 larger sized compartments, each measuring about 25 x 83mm. The lid slides on, and keeps all the goodies in their place. Ideal for capacitors, plugs, transistors etc, etc, etc. Total size 275(W)x418(L)x21(D). Cat. HB-6344 $11.95

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New in 98

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New in 98

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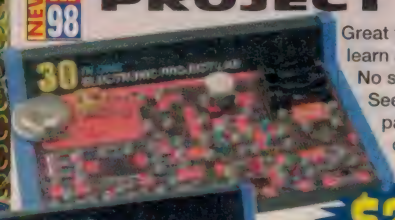
Cat. AV-6505 **$79.95**

30 IN ONE ELECTRONIC PROJECT LAB NEW in 98



Great for children to learn about electronics. No soldering required. See our 98 Catalog page 19 for full details.

Cat. KJ-7020

$29.95

60 IN ONE NEW in 98

Cat. KJ-7025

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Generates llight patterns using a unique floating mirror mounted inside. See Cat. page 207 for full details.

Cat. ST-3105

SAVE $10 **June $59.95**

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See 98 Cat. page 90 for details.

Cat. SB-2572

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NEW in 98

Cat. QM-3525 **$149.50**

24V DIL RELAY NEW in 98

Low profile DPDT relay. Takamisawa A24W-K and NEC EA2-24. Way below normal price.

Cat. SY-4020

Only $1.50 ea. 10 for $10

SIEMENS 24V SPST RELAY

These high quality sealed PCB relays are made in Germany. Super price.

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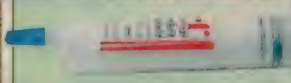

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Brand new unit. This converts a video and audio signal into an RF PAL colour TV signal.

Specifications:
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•Size 35 x 31 x 15(H).

Cat. LM-3850 **$14.95**

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Value $6.95

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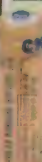

Cat. SB-2452 **Normally $2.50 ea.**

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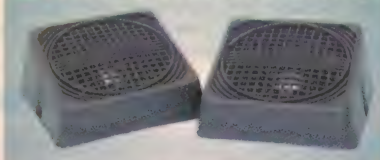

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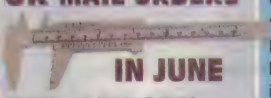

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- Motorola 8500,8700 Cat.HC-6926
- Nokia 2110 Cat.HC-6930
- Nokia 1610 Cat. HC-6932
- Nokia 8110 Cat.HC-6934
- Nokia 3110 Cat.HC-6936
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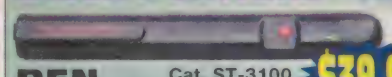
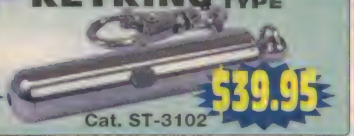


KEYRING TYPE Cat. ST-3102 $39.95



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MADE IN JAPAN

We sold these high Quality Japanese detectors in 1996 for $99.95 and have secured a limited quantity of 10 and 15 metre-range units for a fraction of their 1996 sale price. For the unit to trigger an alarm, both the PIR and microwave detectors must be triggered at the same time - substantially reducing the chance of false triggering. Two models are available, a 10 metre range for domestic security and a 15 metre range for warehouse and halls where a long narrow beam is required.

10 METRE LONG RANGE	Cat. LA-5012	$69.50
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Save $10
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RED 240V STROBE

Flashes at approx. 120 times/sec. Standard 240V BC fitting.
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IT'S NEW

This low voltage landscape light increases security around the house as well as lighting up your garden. It is made of diecast aluminium and is black powder coated. It includes a ground spike and is waterproof. Use 12V halogen lamps in 20W or 50W. (not supplied)

Use the following lamps:
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50W 38° 12V ($4.95) Cat. SL-2732

Cat. SL-2758 $19.95

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SOUND IC DATA & SUBSTITUTION MANUAL

This brand new book lists data, substitutions and functions, as well as a drawing and block diagram on over 600 commonly used audio IC's. Prefixes of some of the types listed include AN, BA, CX, CXA, HA, KA, LA, LB, LM, NE, SA, TA, TBA, TDA, TEA, µPC, STK. Softcover 148 x 210mm. 548 pages.
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Rubber foot pad, made in England, connected to a plastic tube 6mm dia., 3mm hole. It produces a pulse of air suitable to operate an air switch - eg spa air switch. Note: No switch supplied - just the foot pump mechanism. **$5 ea**

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Fully encapsulated, PCB mount. •Input 2 x 120V (series for 240V) •Output 2 x 12V at 1.25A each. 30VA total. Size 67 x 56 x36(H)mm.

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Philips 600V 16A plastic case SOT186 triac with isolated tab.

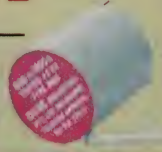
Normally around $4.50

These are: $2.50 each or 10 for $18

4700µf 35V RT ELECTROLYTIC CAPACITOR

$2 each. 10 FOR $12

600Ω /600Ω 4KV TRANSFORMER



Dyne Industries type 8003. Telecom Approved.

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3 1/2 DIGIT RUGGED DMM

•Large 18mm digits •Auto zero •Auto polarity •20A (DC)

Cat. QM-1430

$34.95

AC CLAMP METER FOR DMMS

This rugged adaptor plugs into your digital multimeter to allow high current AC measurement up to 300 amps.

See Cat. page 23 for full details.

Cat. QM-1565

$39.95

KEYFOB REMOTE CONTROL CASE

We've finally found some! These are extremely hard to get. Its the empty transmitter case as used in car alarms. The case includes the switch contacts, battery terminals, key chain and screw to hold together. OEMS contact our wholesale division for bulk prices.

Cat. HB-5605

$3.95

NEW KITS

UHF/VHF MASTHEAD AMPLIFIER KIT

REFER: EA JUNE 1998

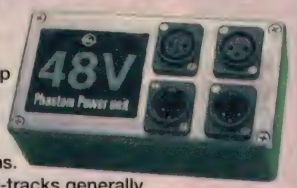
If you struggle in a poor reception area for a quality picture - you probably need a masthead amplifier to solve the problem. Build this simple kit and save $$$ over commercial models. Kit is complete with PCBs, case, electrical conduit housing plus all components. Plugpack required, use our MP-3003 $11.50

Cat. KA-1810

$34.95

PHANTOM POWER SUPPLY KIT FOR MICS & DI BOXES

REFER: EA MAY 1998



There are a number of situations where this phantom supply will help produce a superior and more reliable quality of sound in both recordings & PA systems. First, home studios or 4-tracks generally don't have phantom power to use quality condenser mics; many older PA mixing desks have phantom power that either performs badly or doesn't work at all. Kit is supplied short form with PCB, transformer plus all specified electronic components. Refer to our 98 Catalogue for our range of suitable XLR connectors and enclosures to suit your personal requirements.

Cat. KA-1808

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Construction Project

48V Phantom Supply for mics and DIs

If you use phantom-powered microphones or direct injection (DI) boxes, you'll also need a compatible phantom power source, such as that built into many mixing desks and recording consoles. When this power source isn't up to scratch in some way (or it's just not available), you'll need a separate 'outboard' supply box to do the job. The unit described here costs a fraction of equivalent commercial units, is easy to build and can be expanded to handle up to four microphone channels.

by Rob Evans

Put simply, a phantom-powered device is one that receives its operating power from a remote source, via the interconnecting signal cable. A masthead booster amplifier for TV signals is a common example of this concept, where the booster amp is located up on the TV antenna itself, yet its power source is at the television receiver end of the signal cable. The crucial trick here is that the standard (single-core) connecting cable carries both the amp's output signal *and* its DC supply voltage.

Phantom-powered microphones and DI boxes use exactly the same principle. But in this case the mic (or DI) is powered from the mixing desk end via the standard microphone cable, which also carries the audio signal. The only real distinction here is that the mic cable is a two-core type and carries the audio signal in a *balanced* (or differential) format, while the 48V phantom supply is applied to the two lines in the *common* mode.

In real terms this means that the audio is applied *between* the two cores (with the shield playing no direct part), while the DC power is available between both cores and the shield. By the way, if you're not really familiar with the balanced system used with microphones signals we'd suggest that you take a look at our past DI box project articles in the October '87 and January '98 issues of *Electronics Australia*, where balanced mic lines are covered in some detail.

Balanced lines aside though, phantom power has been with us since the post-war era, when the respected German microphone manufacturer Neumann introduced high-quality condenser mics with solid-state electronics. These mics needed a relatively high-voltage supply (in solid-state terms) to polarize the diaphragm, plus a DC source for the FET-based preamp stage — so Neumann developed a remote 'phantom' powering system for their range of condenser mics.

This 48V-based system worked well, and over time became the default powering standard for professional condenser microphones. It was later defined (and slightly enhanced) in the DIN 45596 standard and has remained in use ever since, despite the more recent advent of 'self-polarized' electret diaphagms which allow so-called condenser mics to run from a low voltage source.

It's hardly surprising then that most professional-grade mixing desks have DIN 45596-compatible power available at their mic input sockets, so that phantom-powered mics, pick-ups and DIs can be used. Depending on the desk, this can be built into all or just some of the mic channels, and can be switched on or off for all channels, in groups of four or on an individual channel basis.

So with phantom power being offered by

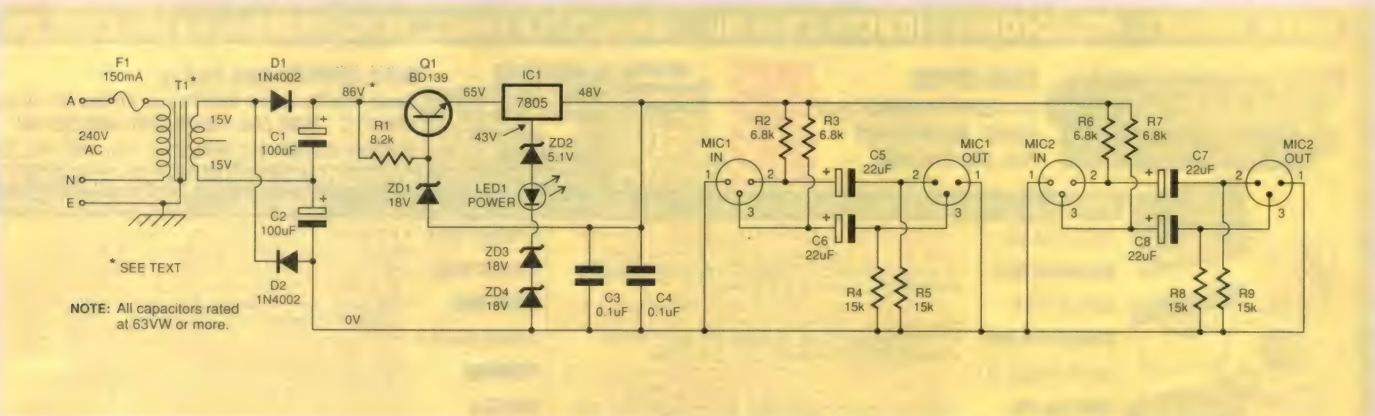


Fig.1: The phantom supply's 48V rail is produced by a 'jacked-up' 5V regulator chip IC1, which is fed from by a simple 65V pre-regulator stage based on Q1.

most 'serious' mixing desks, you may wonder why a separate, dedicated phantom power box would be of any real use in the sound reinforcement and recording area. The answer here is simply that *all* desks don't have phantom power, and some of those that do perform badly when it's switched on...

A prime example of where the phantom power box will benefit a mixing setup is a low-cost home recording setup, based on the popular four track cassette-based recorders/mixers from companies like Fostex and Tascam. These recorders offers surprisingly good performance (considering the storage medium), and can be used to create quite effective recordings in your own mini home studio.

The problem here is that because these recorders *are* so capable — particularly the newest digital versions — the recording microphone itself tends to become the factor that limits the clarity of the recording. And as many users have found, changing from a standard dynamic mic to a professional-quality condenser mic can give the recording an astonishing lift in clarity and presence.

A phantom power unit is needed before this can happen, since four-track recorders are rarely equipped with the phantom power needed by the above mics, and mostly don't have balanced XLR inputs either. So if you use a four-track recorder, do yourself a favour and beg, borrow or hire a medium-priced professional condenser mic (for example, an AKG 451), then record a few vocal and acoustic instrument tracks — you won't look back...

A portable phantom power box can also be invaluable when using 'in-house' sound reinforcement (that is, PA) systems in clubs and pubs, where the equipment is invariably both well used and abused. Here the mixing consoles will often be equipped with phantom power, but due to lack of maintenance, it either performs badly (it's noisy and poorly regulated) or doesn't work at all. This problem is neatly solved by turning the desk's phantom power off, and using our Phantom Power Box on just those channels where it's needed.

There can still be problems when the quality of a desk's 48V supply is fine, but it can only be turned on and off 'globally' — that is, for *all* inputs rather than on an individual channel basis. When applied, this means that phantom power will be present at all mics, DIs and any other gadgets connected to the desk's input channels, regardless of whether they are phantom-power compatible or not.

Even standard dynamic mics can cause trouble in practice, despite the fact that their simple output stage is compatible with phantom power. When a dynamic mic is handheld for example, the 48V at its XLR connector can make intermittent contact (say, due to corrosion on the pins) as the vocalist moves the mic. In theory, being a fully balanced system this shouldn't produce any clicks and thumps through the PA system, but in the less-than-ideal world of in-house PA's, it invariably does...

So as you can see, there are a number of situations where a free-standing phantom power box will help to produce a superior and more reliable sound quality, in recording and PA systems. For the low cost of building one up, it's worth having one at hand even if you don't have an immediate use.

As you can see from the shots of the prototype, our Phantom Power unit is powered directly from the 240V AC mains, and has been put together in a relatively small box as a *two* channel unit. The circuitry itself will handle up to four channels though, so its internals can be fitted into a larger case to make room for the additional XLR connectors.

Note that the construction technique is not really critical with this project, so the XLRs can be fitted to the box side panels if this is more convenient. It could even be built up in

a industry-standard rack mount case if you don't mind the price overhead for the box, and thanks to the flexible nature of the circuit design you can also use a variety of power transformers.

The circuit

The Phantom Power unit's circuit is a slightly unusual arrangement, and as you can see from the schematic shown in Fig.1, uses a series pass transistor (Q1) plus a standard 5V three-terminal regulator (IC1) to generate the 48V supply rail. This is then applied to the balanced input sockets via 6.8k isolating resistors, as defined in the DIN 45596 phantom power specification, while just the audio signal is passed to the output sockets via DC isolating capacitors.

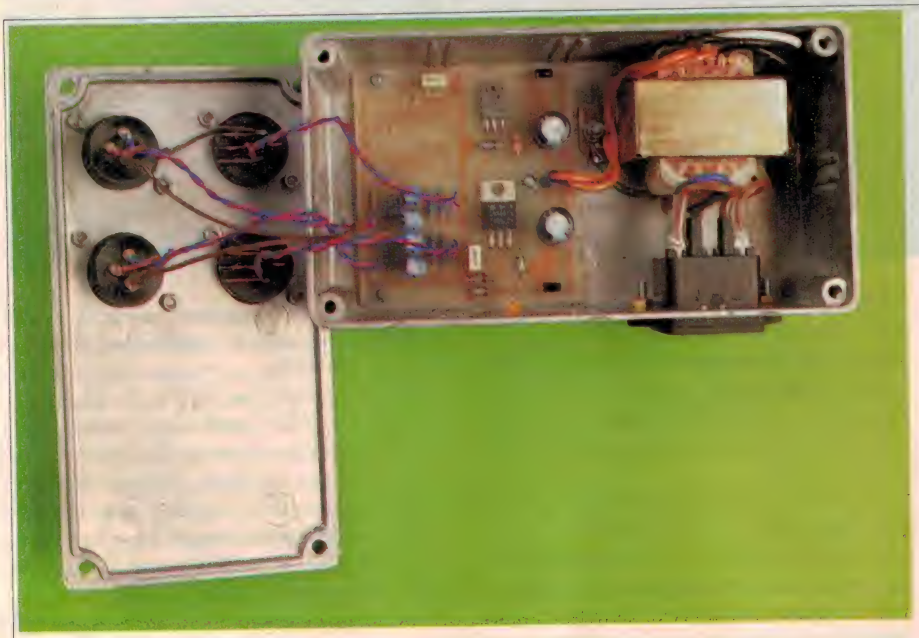
Working through the circuit in more detail, the 30V AC secondary voltage at power transformer T1 is applied to a simple voltage doubler formed by D1, D2, C1 and C2. This can be thought of as two half-wave rectifiers, where relative to the junction of C1 and C2, D1/C1 generates about +43V and D2/C2 produces -43V. Since the circuit actually uses the junction of D2 and C2 as the 0V reference however, the overall output level is around 86V DC.

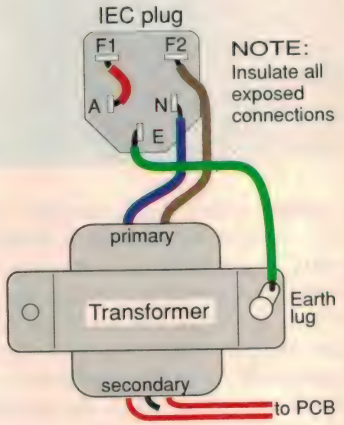
The 'raw' 86V supply is then applied to a simple pre-regulator stage based on the BD139 transistor Q1, which drops the source voltage to a safe level for the following regulator chip IC1. Here, ZD1's anode is held at 48V by IC1's output, so the base of Q1 (ZD1's cathode) will be fixed at 66V by the 18V zener and bias resistor R1. The emitter of Q1 is therefore held at a constant level of about 65V, regardless of source voltage fluctuations at its collector.

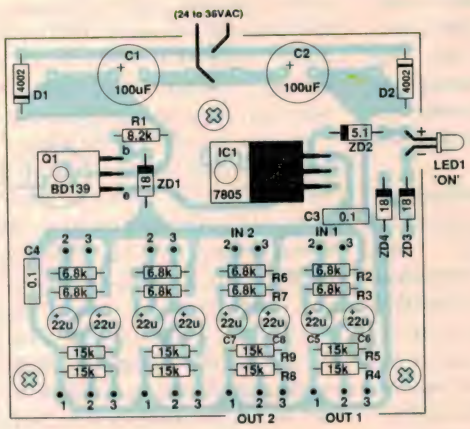
This constant voltage is applied directly to the 7805 5V three-terminal regulator chip IC1, which has its reference (or common) leg 'jacked-up' to 43V by zeners ZD2 to ZD4, plus LED1. As the 7805's output is locked to 5V above its reference leg, the final output from the regulator stage is therefore a stable 48V. Note that a quite consistent current of around 7mA flows from IC1's reference leg via the zeners and LED1, so the power indicator LED offers a useful level of brightness plus a fixed voltage drop of around 2V.

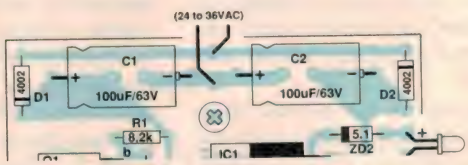
Despite its simple circuitry though, this overall regulator arrangement works well and offers a stable, but perhaps more importantly, a very 'clean' 48V output at the microphone input terminals. In practice, this latter attribute is essential for phantom power applications where 'active' devices (microphones, etc) are powered by this voltage, and deliver low signal levels through the system. Conversely, the supply's *load regulation* will have little effect, since phantom powered devices are quite immune to slow and broad changes in the 48V source.

The other point to consider regarding the regulator design is it's ability to handle a wide input voltage range, or in reality, power transformer secondary voltages between 24V and at least 36V (as mentioned earlier). At the high end of the scale, the pre-regulator stage (Q1) simply takes up the excess









The component overlay diagram (Fig.2, left) shows the components for all four channels installed in the PCB. As you can see from the internal shot of the prototype (above, left), we've only fitted the parts needed for our two-channel unit. Note that Fig.3 (above) shows the mounting positions for the axial versions of C1 and C2, and Fig.4 (above, right) illustrates the power supply's AC wiring connections.

with a proportional increase in its power dissipation, so a heatsink may be needed in some circumstances — more on this later.

At the low end of the input voltage range however, the pre-regulator stage may not be able to maintain its 65V output due to the low source voltage. With a 24V transformer for example, the pre-regulator's (nominally) 68V source will drop significantly when the box is loaded by a couple of phantom powered devices, causing Q1's output to fall.

In this case the pre-regulator's output just tracks the input voltage, but at roughly 4 volts less. As you would expect though, the 7805 regulator will have no trouble maintaining its 48V output under these conditions, provided *its* input doesn't drop below about 50V. So in raw source voltage terms, the overall regulator stage can cope with a DC input range of around 54V (50V + 4V) to at least 100V.

Moving along from the regulator stage, you can see that the 48V rail is applied to both pins 2 and 3 of the XLR input sockets via 6.8k isolating resistors, as per the DIN 45596 standard. This fully balanced arrangement is repeated for the 22uF input-to-output coupling capacitors, which remove the DC component from the output signal, plus the 15k output terminating resistors.

Only two balanced input/output circuits are shown here, but as previously mentioned, both the PCB and 48V regulator can accommodate up to four coupling circuits.

The rear panel of the box holds the IEC mains connector and the supply's small power indicator LED - the box shape and size really aren't critical, by the way.

Construction

The first step in putting the Phantom Power unit together is to decide how many microphone channels you want to install, since this will effect both the box size and transformer rating. As you can see from the shots of our prototype, we've built up the two channel arrangement as shown in the schematic diagram and housed the unit in a standard die-cast aluminium case. This 150 x 80 x 50mm case is about the smallest that can be used, by the way.

If you decide to build a four-channel unit, then a larger case will be needed to accommodate the eight XLR connectors, even though the size of the internal circuitry remains the same. In fact the Phantom Power unit's internals will suit a wide range of box styles, and while the case should really be of a metal construction (for both shielding and strength), just about any case that's big enough will suffice.

A number of different power transformers will also do the job, since the 48V regulator stage accepts a wide range of input voltages (as mentioned above) plus the secondary current demand is quite low. If you elect to build the four channel unit however, some 24V (or 12-0-12) transformers may not deliver enough output to guarantee a clean 48V supply when *all* four channels are in use — that is, the regulator's DC input may drop below the critical 54V level.

The simple answer here is to use a 30V (15-0-15) transformer in a four channel unit, as it will provide the voltage headroom needed. Note that you will probably need to install a small heatsink on Q1 when a 30V or higher transformer is used in a four channel unit — a 36V (18-0-18) transformer will make the heatsink essential, for example.

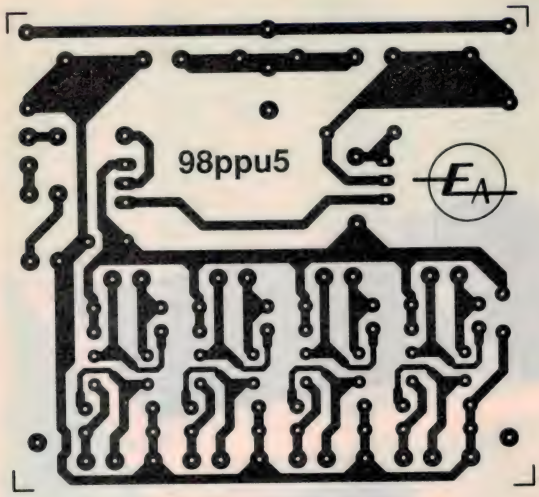
With the hardware decisions out of the way, you can now assemble the unit's PCB (coded 98ppu5) module while using the component overlay diagram (Fig.2) plus internal shots of the prototype as a guide. As usual, pay particular attention to the orientation of all semiconductors and electrolytic capacitors, and double check your work as you go. Also, all components should be mounted flush with the board surface, and PCB pins used for all of the external connection points.

Note that the 100uF/63VW main filter electrolytics can be axial rather then vertical-mount types, if this is more convenient, and the alternative mounting position is shown in Fig.3.

Other than that, if a small heatsink *is* needed for Q1, make sure that it can't come into contact with the case or other components, and is held firmly in place — you may need to fit a bolt through the PCB, heatsink and transistor to achieve this. Also note that the power indicator LED is installed with its body well above the PCB, and this ultimately penetrates the case though a small hole. We 'kinked' the legs to help with this alignment and to provide a degree of strain relief.

With the PCB completed, this can be installed in the case via suitable mounting holes and standoffs. As the lid-mounted XLR connectors are positioned just above the PCB when the box is closed, you will need to mount the circuit board quite low in the case to avoid contact between the XLR pins and PCB components. We simply included an additional nut on each mounting bolt, as a spacer between the PCB and case. Double check that the spacer nuts aren't contacting nearby PCB tracks, though.

Next, the power transformer and IEC mains connector can be installed, then wired as shown in Fig.4 and the schematic. Take particular care with the 240V AC wiring, and make sure that the mains earth connection is solidly connected to the case/transformer as shown. Note that the Phantom Power unit's circuitry is fully floating, and while it doesn't have a direct (or local) connection to the mains earth, it's ultimately



The PCB artwork (left) is shown at its actual size, for those who make their own boards, while the front panel art (right) is also reproduced at full size.

PARTS LIST

Resistors
(0.25W 5%, unless specified)

R1	8.2k
R2,3,6,7	6.8k 1%
R4,5,8,9	15k

Capacitors

C1,2	100uF 63VW electro, axial or PC - mount
C3,4	0.1uF MKT
C5,6,7,8	22uF 63VW PC-mount electro

Semiconductors

IC1	7805 three-terminal regulator
Q1	BD139 NPN transistor
ZD1,3,4	18V zener diode
ZD2	5.1V zener diode
LED1	3mm LED
D1,2	1N4002 (or equiv) power diode

Miscellaneous
PCB 68 x 64mm, coded 98ppu5; power transformer, 30V 150mA power transformer, or similar (see text); 2 x panel-mount 3-pin XLR (Cannon) sockets; 2 x panel-mount 3-pin XLR (Cannon) plugs; metal box, 80 x 150 x 50mm or larger (see text); panel-mount IEC mains plug, with fuse holder; 150mA fuse; rubber feet; light-duty hookup wire; cambric or heatshrink sleeving; earth lug; PCB pins; nuts and bolts, etc.

grounded at the mixing desk end via pin 1 on the XLR output connector.

The power transformer secondary leads and XLR connectors can now be wired to the PCB, again as shown in the overlay diagram. As you can see from the shots of the prototype we used twisted wire pairs for the pins 2 and 3 XLR connections, which theoretically helps to maintain the balanced system's noise rejection — mainly though, it makes for a neater wiring job...

Preliminary checks

With the Phantom Power box now complete, there are a couple of measurements that can be made before the unit is used in practice.

Start by applying power to the unit and quickly checking the voltage at the *input* XLR sockets. There should be very close to 48V DC between pins 2 and 1, and the same reading between pins 3 and 1 — if not, turn the unit off and thoroughly re-check your work.

In the event of a problem, start by checking that the 7805 regulator or Q1 are not getting hot, due to a PCB track short or wiring error. If all's well here, check the circuit voltages shown in the schematic, starting with the 'raw' supply voltage across C1 and C2.

This is best measured between the cathode of D1 and the anode of D2, and should read around 86V for a 30V AC power transformer — as shown in the schematic. An incorrect level here would indicate a problem with D1, D2 or the transformer wiring. By the way, with other transformers this voltage can be calculated by multiplying the AC secondary voltage by $2\sqrt{2}$, so for example a 24V transformer should deliver a raw DC level of around 68V.

The other important clue in the event of a problem is the power indicator LED, which as you would expect, should be illuminated. As this is connected in series with IC1's voltage reference leg (along with the zeners), a lack of brightness in LED1 will indicate that the raw DC source voltage is not getting to the 7805 (a problem around Q1), or the current path is broken between IC1's reference leg and 0V (a faulty connection at ZD2 to ZD4, or LED1).

If the 48V rail is reading low, check the string of zeners for the correct voltage rating and orientation — needless to say, a zener will only drop around 0.6V when connected the wrong way around. Note that the final voltage at IC1's reference leg should be close to 43V, its input voltage around 65V, and the base leg of Q1 at close to 66V (as set by the 18V zener, ZD1).

With the static tests out of the way, you can connect a phantom-powered device (microphone or DI box) to the unit and make a final performance check. The signal arriving at the mixing desk end should be at full strength — indicating that the device is receiving phantom power — and free of extraneous hum and noise. If all's well, the Phantom Power unit's 48V output will be very clean and should not contribute to the passed audio signal in any way. ❖

Information Centre

by Peter Phillips

Tiny tubes revisited, digital TV, arcade games & more

Our range of topics this month includes the dreaded Year 2000 bug (Y2K) and its possible effects on basic appliances, an intercom system with a few interesting features, and how those light guns work. We also discuss digital TV, and start with a simple construction project.

The April 1998 issue included a construction project called 'Tiny Tube' Portable Lights - 1, based around the tiny backlighting tube from a laptop display. Part 2 was published in the May issue. Being an inveterate designer, I particularly enjoyed developing the three applications described in these articles, so much so that I've developed a fourth unit that could interest you.

Perhaps my main source of enjoyment with these designs is that they are all based on either disposal parts, or bits and pieces found in a typical workshop. They are therefore a true hobbyist project, as well as being inexpensive and useful. The fourth design follows these same principles.

The unit is shown in Fig.1, and includes a light dependent resistor (LDR) to cause the light to switch on when the ambient light falls below a preset level. I wanted such a light in my garage, to avoid stumbling around in the dark after parking the car at night. I had previously used a 10W compact fluorescent light switched on by a time clock, but the CFL lamp only lasted six months. As these cost around $18, I decided to scrap the idea and make the design I'm now presenting.

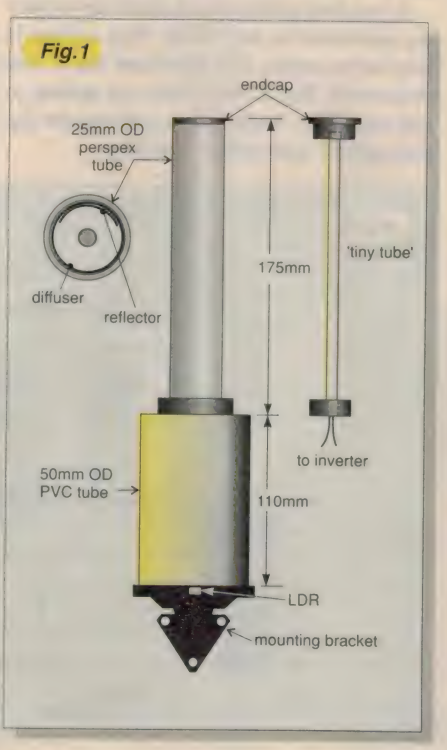
It has three significant advantages: the tube will last around four years (assuming an average on-time of nine hours per day), takes only about 4W of power and can be battery powered. I'm using a 12V 6Ah gel cell, trickle charged by a plug-pack type lead-acid battery charger, available (as a disposal item) from Oatley Electronics. So in a blackout, I can now more easily find torches and other lights stored in the garage...

You might think the design of the unit is quite simple. But there's a trick that enhances the light output, so much so that it lights an area of 10 square metres or more, all from a 4W input. I'll get to the 'trick' shortly, but first a short description of the construction.

As shown in Fig.1, the base holding the inverter and its transformer is made from PVC tube. This tube is supported by a plastic bracket that has a universal mount, allowing the light to be angled if required. The bracket is a disposal item, again from Oatley Electronics. To attach the PVC tube to the bracket, I mounted a screwtop lid from a plastic container to the base of the bracket. The tube simply pushes over the lid, avoiding the need for screws.

The 'tiny tube' is mounted inside a length of perspex tube, supported by endcaps that push into the tube. These endcaps also have another function, which is where my 'trick' comes in. The tiny tube produces a lot of light, but the best effect is achieved by appropriate use of the diffuser and reflector materials from the original laptop display.

All you do is wrap a layer of diffuser material *inside* the perspex tube, with a strip of reflector material layed over the diffuser, behind and running the full length of the tube. These materials are held in place by the endcaps, which can be a cork or — as in my case, something you turn up on a lathe. The details are in Fig.1.



To marry the perspex tube and the PVC base, I ratted the case from an old electronic buzzer, which after a bit of scraping and filing pushed into the PVC tube. The perspex tube was also a push fit into the buzzer case, so again no screws. The end result, after spraying the PVC tube with black paint, is a smart looking light that would not be out of place in any decor, let alone a garage.

I fitted the LDR on the front of the base of the mounting bracket, with a 500kΩ 10-turn low profile trimpot under the base. This means I can adjust the sensitivity without disassembling the light. The LDR and trimpot connect to the inverter as shown in Fig.2.

The only other adjustment is the light output from the tube, which is set by VR1 in the circuit shown in the April '98 issue (page 56). I set this control so the current taken by the inverter was around 350mA. The whole unit took less than four hours to make, and is light enough to mount on a plasterboard wall. The DC power lead passes through a hole in the bottom of the bracket.

Now for some reader letters, starting with a question about digital TV.

Digital TV

Much has been written lately about the advent of digital TV. But, as our first letter points out, there's been little information on the technical aspects...

I am conversant with AM and FM radio and TV in its present analog form, but I have not yet seen any articles on the digital format. Am I correct in assuming that some sort of packet transmission is achieved by switching the RF carrier on and off in accordance with the ones and zeros of the bit stream, or is a more sophisticated form of FSK or PSK used? I would appreciate an article on this subject, including an illustration of the RF signal waveform. (H. Harvey, Taringa, Qld)

Like you Mr Harvey, I haven't seen anything that describes the transmission method. I'm including your letter in the hope a reader

might be able to enlighten us. However, I have been looking for information since receiving your letter, and I found the following in the *Sydney Morning Herald*:

Basically, digital technology allows up to four transmitted signals on an allotted broadcast bandwidth, each one capable of offering picture quality on a par with existing free-to-air (FTA) channels, providing there's not too much activity on screen, such as in a news program or a snooker tournament. However, the technology also enables each channel to broadcast high-definition television pictures, which requires the full bandwidth. The transmission will be in the UHF band.

The Australian (March 25) ran a headline: Free-to-airs win decade of digital TV, pointing out that digital TV starts January 1, 2001, data broadcasting begins at the same time, existing free-to-air TV networks get free use of the spectrum until 2008 without competition, but cannot broadcast pay TV or multi-channelling. Existing networks will also be allowed to use digital technology for data, and the progress of the system will be reviewed in 2005.

Federal Communications Minister Richard Alston is quoted as saying: "By adding a simple decoder box, a digital TV set can detect data signals which offer a host of new services. The set effectively becomes a one-stop shop in every home". The article concludes by saying: "An inquiry will be held into whether the ABC or SBS might be given an exception to broadcast multiple channels."

Of interest to me, and no doubt to many readers, is the question of high definition TV (HDTV). Quoting *The Australian*: "However, the FTA stations, which had based their arguments for free digital spectrum on the benefits of HDTV, yesterday gave their first indication that a digital TV model based purely on HDTV might not prove viable". I interpret this to mean that many people won't spend the money to get a HDTV set, making digital broadcasting less attractive to commercial TV stations. Only time will tell.

Intercom system

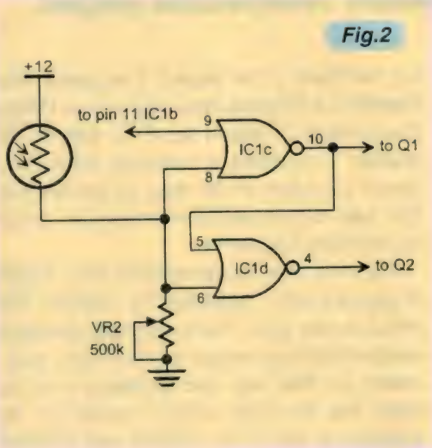
If you have a two story house, you'll probably appreciate the benefits of an intercom system. No more screams between floors of "you're wanted on the phone", "dinner is ready" and so on. The following letter seeks advice on a rather complex system that, according to our correspondent, costs over $1000 as a commercial item.

I have been looking for some considerable time for a circuit which would enable me to build an intercom system. Simple enough you say, but there's more. It needs to be an 'all master' system. That is, all stations can call all stations, though not all at the same time. I can see how it can be conceived, but lack the expertise to bring the concept to fruition.

Investigation through the retail sector reveals there are such units on the market (two types), but they cost over $1000. It's been suggested that an old Telstra Commander system might suit me, but Telstra tells me they recondition these units (for this use), and the cost is almost the same as the commercial units.

Has EA published such a design? If not, perhaps you or a reader might be able to help. (Nicholas Smith, Ballarat, Vic)

Years ago I designed a comparatively complex hardwired intercom system for my house, which has proved its worth almost every day. However Nicholas, your requirements are somewhat different in that my system simply had stations that communicated to all other stations.



A possible solution is an intercom project we published in July 1992. This system is relatively simple, and therefore has a few limitations. But it does allow one station to call any other. It also gives a design for the microphone and speaker amplifier.

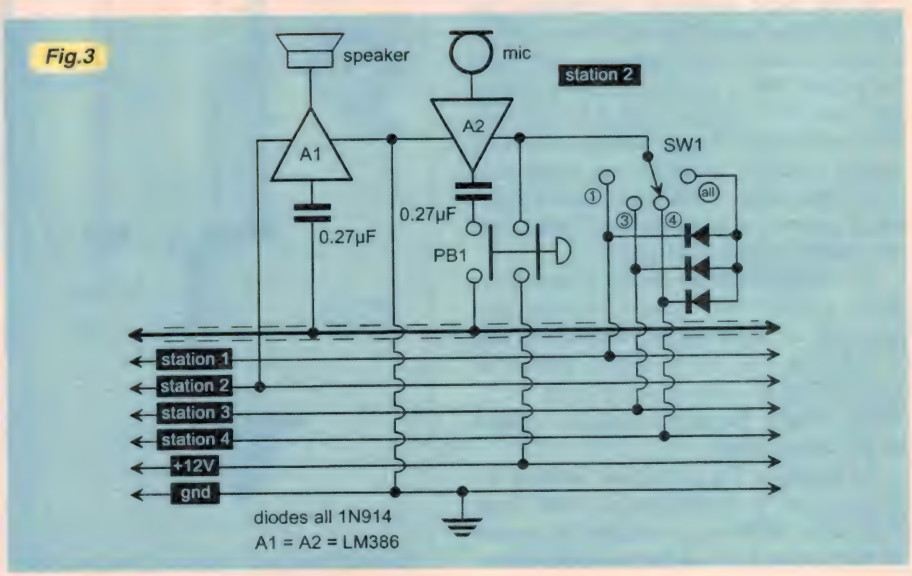
However, I've developed a preliminary design that might be more appropriate to your needs. The circuit is shown in Fig.3, and is for four stations hard-wired with a shielded cable (for the audio signal) and a six-core telephone cable. The circuit shows the details of station two, and all other stations are similar, except for the connections to the six-core cable, which I'll explain shortly.

When PB1 in station two is pressed, it connects the output of its microphone amplifier to the common shielded cable. It also connects the +12V DC power source to the mic amplifier and to the calling station select switch SW1. This switch is set to either the station you want to call (one, three or four), or to the ALL stations position.

Let's say SW1 is set to station four. The +12V DC is present on line four while PB1 at station two is pressed, which powers the speaker amplifier in station four. This arrangement doesn't identify the calling station, but the caller can indicate this verbally. The person being called then selects the calling station if a two way conversation is required, which in this case is to station two. When PB1 at station four is pressed, power is supplied to the speaker amplifier at station two, and the mic amplifier in station four.

If someone wants to talk to all stations, SW1 is set to the ALL position. Pressing PB1 supplies power to all lines (except the calling station), so all receiving stations are powered up while PB1 is pressed.

The other stations are wired in much the same way, except the speaker amplifier is powered by the line for that station, and the connections from SW1 are to all lines except the line for that station. Additional stations require another line, so the only limitation on the number of stations is the number of lines in the multi-core cable.



The system is powered from a single 12V DC source, and no power is taken by the system until PB1 at any station is pressed. You might get away with using an unshielded cable for the audio signal, as suggested in the July '92 design.

Micros and Y2K

We've all heard of the millennium bug (sometimes called the Y2K bug), along with predictions that include a great depression, aircraft crashes and so on. These are all associated with the date code in computers, but what about more basic appliances such as a microwave oven or washing machine fitted with a microcontroller?

Last October I wrote to you about the effect of the year 2000 computer bug. There's no doubt about the reality of this bug, but the question I want answered is whether it will affect microprocessor controlled appliances which do not overtly use year timing, but which nevertheless use standard computer chips with year timing built in. Would you please consult with all the computer experts you have access to, and publish the answer to this question. (Nicholas Smith, Ballarat, Vic)

It's an interesting question Nicholas, and one I'm sure the experts will have differing opinions on. We don't have access to computer 'experts' whose opinion we could guarantee, so I'm presenting your letter so readers can comment.

Nicholas also sent a newspaper clipping that includes an Internet address about the Y2K issue. The address is **www.year2000.com**, and the site has a countdown clock of the number of days, minutes and seconds to the fatal moment, plus a huge number of press clippings, a discussion forum and so on. I couldn't find any information on microcontrollers, but I didn't spend a lot of time looking as my deadline for this month's column is rather tight...

Light guns

In the April issue, a reader asked how shoot-em-up arcade games work. That is, how does the game know when you've aimed correctly? I've had a few letters from readers about this, including one from a reader who services these games. It turns out there are at least three methods:

I know of three methods, from my many years of experience of working on arcade games. The first is an electro-mechanical system in which the gun is on a fixed mount with a swivel at the base, allowing you to aim at any part of the target area. Underneath, it has an arm with a contact point on the end, placed over a circuit board with copper studs riveted in places that correspond to the targets on the game.

When you move the gun up or down, the arm moves back and forth across the PCB, and when you move left or right, the arm moves across the board. Each target has a trip solenoid under it and when the trigger is pulled and the arm rests on a stud (ie, you've aimed correctly), the target trip coil connected to that stud energises, making that target drop, giving the illusion it has been 'shot'.

The second method is used in games that have heavy guns, such as 'Terminator 2'. These have the same swivel base as above, but the sensors are two 5k pots, one to sense the up-down movement and the other the left-right movement. The two signals (one from each pot) are sent to the game computer where A-D conversion takes place.

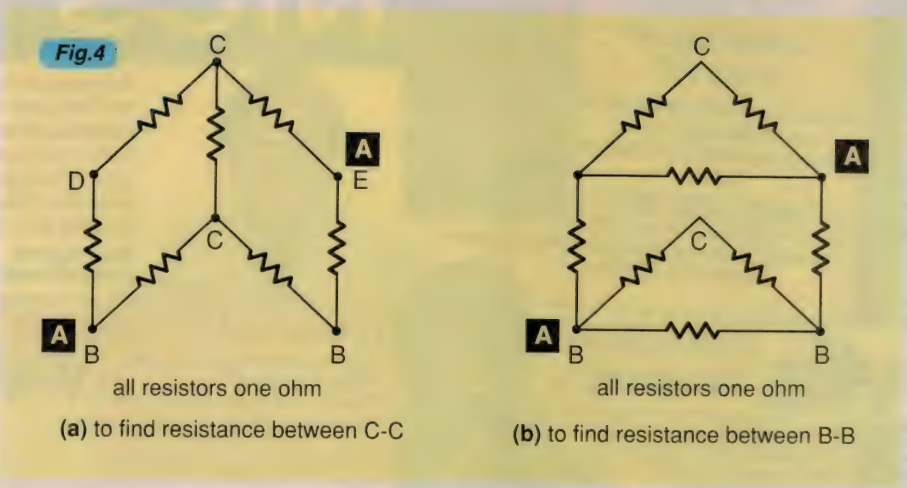
Calibration is needed, as the display can vary slightly in width, height and centering. The calibration is done in the game's test mode, where the computer places an 'X' in three strategic places on the screen and tells you to shoot at it. This method of gun sensing is the most reliable, but requires good quality heavy-duty pots with integral clutch (costing between $35 and $60 each).

The third method uses optical guns — the only way for handheld guns. These have a lens inside the barrel and a light sensor positioned further back. The output from this sensor is amplified and sent to the game PCB.

In most commercial video games, the game data is bit-mapped into RAM by the CPU, usually during the screen blanking interval. The RAM is scanned onto the screen via its address bus from a series of cascaded BCD counters that are run from the system's crystal oscillator. This is called the horizontal sync countdown chain, and all sync and other pulses are derived from here, including a vertical timing chain.

The outputs from the timing chains (H and V) are also presented to the inputs of (usually) a number of 74LS373 latches that are enabled when the trigger is pulled, and therefore latch the precise horizontal and vertical position data from the two countdown chains. This is the least reliable method, due to factors such as dirt, screen brightness, other light sources and so on. (Kendrick Reed, Hervey Bay, Qld)

Many thanks Kendrick, you've answered a question I know a lot of readers will be interested in. Because of space limitations, I've left out a few of the other points you made, but at least we now know what's going on in these games.



Lithium rechargeables

As I can't answer the following question, perhaps a reader can help:

I have several Vanadium Pentoxide lithium rechargeable batteries, made by Panasonic part number VL2330. They are rated at 3V 50mAh. My question is, how do I charge them? (E. De Longis, Midvale, WA)

What??

The question this month comes from John Kilkenny (St Ives, NSW):

You have 12 identical steel balls, all of the same weight except one, which has a slightly different weight to the others. With only a beam balance, what is the minimum number of weighings needed to identify the odd one, and whether it's heavier or lighter than the others?

Answer to May's What

The trick with resistor networks is to recognise symmetry, and to disconnect those resistors that have no potential difference across them. First the resistance between C-C. Here you can remove the resistors between points B-B and D-E, as shown in Fig.4(a). This gives a series-parallel network that solves to 0.6Ω.

Similarly, to find the resistance between B-B, remove the resistor between C-C, as in Fig.4(b). This again leaves a series-parallel network that equals 0.533Ω.

The resistance between A-A is more difficult to find. According to the author of the question, this is best tackled with Kirchhoff nodal analysis. I haven't included the working, as you either know how to do this or not. Or you used a different method. The answer is 0.7333Ω. ❖

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VIFA speakers are back by popular demand and take a look at the three new kits we've just added, Phantom Power Supply, Masthead Amp and Auto Ignition Kits. It's coming up to the end of financial year again, which means now is the time to take advantage of some excellent products being offered at fantastic discounts. As some products are in limited supply, I suggest you phone now to reserve your order!

Best Regards,
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vifa IS BACK AT ALTRONICS!

One of the World's BEST speaker manufacturers, Vifa are synonymous with superb build quality, high specification materials and fantastic performance. These excellent hi-fi drivers are manufactured in Denmark to Vifa's exacting specifications, and are ideal for high-end hi-fi or home theatre installations.

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		Watts Max.	Qts	Vas Litres	Fo
C 3014	D19TD	80			3-20 kHz
C 3018	D27TG	100			2.5-30 kHz
C 3150	C13WG	35	0.44	15	48-6 kHz
C 3160	P17WJ	70	0.35	34.7	37-5 kHz
C 3170	P21WO	80	0.33	113	25-4 kHz

C 3014 D19TD 19mm Dome Tweeter **$35**

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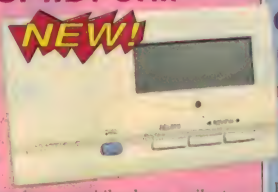
C 3160 P17WJ 6.5" Woofer **$98**

C 3170 P21WO 8" Woofer **$138**

Telephone Caller I.D. Unit



Tired of callers hanging up on your answering machine ?

This simple add on unit will allow you to make use of Telstra's Caller I.D.* facility. It features a three-line screen which displays the incoming callers's number, the time and date of the call. It will also store the last 95 caller numbers in it's internal memory. It will also indicate if the incoming call is originating from a mobile phone, a silent number, or a pay phone. There's even a one-touch dial key for returning calls to the numbers stored in memory. Caller I.D. units are fast becoming the preferred option over an answering machine. Connects with standard U.S. - style modular leads to your telephone and wall socket. Powered by 9V DC plugpack (M 9600).

A 0550 **$59.95**

M 9600 9V 300mA Plugpack **$13.50**

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STEREO MIXERS AT DISCOUNTED PRICES! BE QUICK FOR THESE BARGAINS!!!

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Great for dubbing videos, multimedia, or as a basic PA mixer. Two 6.35mm mic inputs, two RCA stereo line inputs, and two RCA stereo phono inputs. Assignable headphone monitor, LED output level indicators and two stereo outputs.

A 2540 1998 Price $149, NOW **$99**

9 Input Mixer

An ideal DJ Stereo mixer, the A 2550 features 5 channels with 9 inputs, with up to 4 mic, 3 line and 2 phono inputs. Cross-fader between phonos and assignable headphone monitor. Balanced mic input, separate tone controls and twin VU meters.

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A fully built lab power supply with a main output rail adjustable between 0 and 30V, at up to 2.5A. Separate controls for voltage and current limiting. Features Digital LCD Voltage and Current Meters enabling precise adjustment of the power supply for use in research and development labs, instrumentation testing, digital circuits, etc. Also features fixed 12 V and 5 V output rails, at up to 1A peak.

M 8200 Normally $229,

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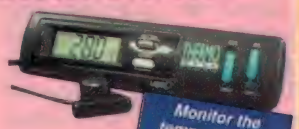

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H 5013	3U	132	122	Raw Aluminium	$89	$80
H 5031	1U	44	38	Black Anodised	$79	$70
H 5032	2U	88	79	Black Anodised	$95	$85
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Secure your vehicle with this versatile *TITAN* car security system.System kit includes alarm module, two remote controls, battery backup siren, shock sensor, valet switch, status LED, wiring harness and hardware.
Features: **• Two remote controls • Super Loud 127dB siren • Remote panic • Battery backup and tamper proof siren • Child proofing and anti intrusion alert while driving • User selectable exit delay and auto re-arming • User selectable arming/disarming chirp • Starter kill • Valet mode • Automatic shunt of defective entry zone • Alarm memory indicates which zone (1-3) triggered • 60 second siren with auto reset • Two colour LED indicator • Can be interfaced with central locking (where fitted) • 3 extra channels on remote to control other vehicle features such as boot release, etc.**

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Mains Filter with Telephone Line Filter

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Protect your investments with this all in one unit!!

This unit will not only protect your PC, printer, etc from zaps coming down the electricity line, but it will also protect your modem or fax, phone from the telephone line. The unit may also be used to protect any household devices like TV/Video's , Sound Systems,etc. This unit is rated at 10Amps, has a 3 Year manufacturers warranty and is Austel approved. Circuit Breaker for Overload protection

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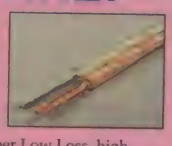

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125W Mini Inverter

This amazing inverter provides up to 125W of 240V AC power from your cigarette lighter socket! Just some of the uses are to power televisions, VCR's, lights, small battery chargers, shavers and hi-fi systems. Features low battery indicator, thermal & overload shutdown. Built-in 3-pin plug (no adaptor required). Includes cigarette lighter socket lead.

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Silicon Chip, April '97

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INCLUDES BLOW TORCH TIP!!

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Statistics show that most people install alarms after the fact. Avoid the trauma of being robbed and install one of these in your home to have peace of mind.

Over the years we have tested and evaluated countless alarm and security products. None have stacked up anywhere near as good as these products. This alarm is an extraordinarily flexible system which represents excellent value for money! The system core is a module containing the alarm circuitry and backup battery, which is hidden inside the house. The system is controlled via a remotely wired keypad located near the point of entry for convenient arming and disarming of the system, and also programming the many options available in this alarm. Up to six sectors can be wired in, as well as a fire alarm input and a tamper loop. The panic input can be set up as a silent (duress) alarm. Sectors can use a combination of normally open or closed sensors and each is supervised by an end-of-line resistor. Main cabinet, keypad and PIRs are tamper switch protected. ***FEATURES:*** **• Master code, 5 user codes, panic and "one time" codes • Battery backup with charger • EOL resistors for sector integrity • Sector bypass • Quick arming option • User settable entry, exit and alarm times • 13 presettable sector types (delay, instant, 24Hr, panic etc) • Preset number of code attempts before alarm sounds • 24Hr type inputs • All functions can be programmed via keypad • Sound and LED prompts during programming to help you through customising your system • Comprehensive installation manual with programming worksheet**

S 5350 Alarm Panel & Keypad Plus Accessories
SUPER PACKAGE DEAL **$239**

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$150 WORTH OF ACCESSORIES *FREE!*
Purchase a S 5350 Microprocessor Controlled Alarm System, and receive a bonus package containing two S 5305 PIR sensors, an S 5462 siren cover, S 5445 strobe light, a large warning sticker and four window stickers, together valued at *$150 FREE!*

S 5075 12V DC 1.2Ah Backup Battery Was $24.95, NOW **$20** ea

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K 1670 Normally $199, NOW ONLY **$179**

Phantom Power Supply Kit

(See EA June '98)
This project will provide 48V DC for powering electret microphones when the mixing or recording desk cannot provide the power. Fully compatible with the DI-Box published in EA FEB '98.
Requires a 16VAC plugpack
Features :
• Expandable to four channel input/output • DIN 45596 standard power output (48V) • Pre-punched rugged die-cast box • Balanced input/output

Commercial units sell for up to $176, build your own and save $$$

K 5558 **$39.95**
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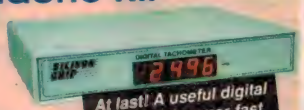
5 Digit Tacho Kit

(See EA Oct '97)
A great high-tech addition to your car's dashboard! This 5 digit tachometer features a crystal timebase for super-accurate readings, a 0.25 second update time and a resolution of 1 rpm. It also has a dimmable display, leading zero blanking, last digit "0" lock (stops "rolling" display), and can read to 60,000rpm if required. Can be configured for ignition coil input (3V) or low level input (1V) from an existing tacho. If you're after a *useable* digital tacho for street or circuit applications, this is it! ***Note: Case NOT included.***



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K 4325 Normally $79, NOW ONLY **$65**

0-45V, 8A Bench Power Supply Kit

(See SC Apr / May '98)
ALL NEW REVISED DESIGN!
Using a new, fully redesigned switchmode circuit, this twin-metered bench power supply will be a great asset to the enthusiast and professional alike. It's switch mode principle allows for smaller transformers and heatsinking which means greater efficiency, less heat and lighter weight.

Massive 8 Amp current capacity and fully variable 0 to 45V DC output rails!

Features: • 0-45V Variable output • Variable current limit • Separate Earth Terminal • Individual Volt and Amp Meters • Constant 13.8V setting • Short circuit proof

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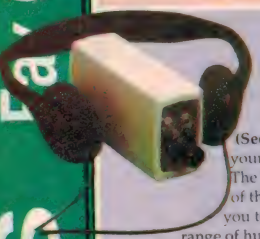
(See EA June '98)
Utilising the new MAR-6 Wideband Amplifier IC, this masthead amp will boost the gain of incoming signals into your TV or FM radio. It is suitable for UHF, VHF & FM signals and reduces noise, snow and hash. Powered by a 9-12VDC plugpack (not supplied). Includes waterproof masthead housing for external mounting.

K 1795 **$34.95**
M 9660 12V DC 300mA Plugpack **$13.50**

"Super Ear" Hearing Booster Kit



(See EA May '98) Expand the limits of your hearing to superhuman levels! The Bionic Ear kit boosts the high end of the audio spectrum, which allows you to hear sounds above the normal range of human hearing. Essentially, the circuit comprises of a microphone or auxiliary input coupled to a high-gain amplifier with a switchable filter to give an apparent boost to higher frequencies. Supplied with an attractive case and all components required to build the kit. Powered by a 9V battery (included!)

K 2125 **$16.95**

Metal Detector Kit

Make your own easy to build metal detector!

(See SC May '98) Designed as a beginner's project for an introduction to induction based circuits. The unit will detect a source of metal by induction pickup and respond with an audible change in speaker tone. The kit is supplied short form with all of the components necessary to construct the unit. Requires a 12V DC supply source.

K 1255 **$17.95**

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(See SC June '98)
Combining 3 earlier designs, this unit is compatible with Hall effect, reluctor and points ignition systems. Using this project and a rotating vane assembly you could replace your points with a Hall effect sensor and eliminate ignition timing adjustments. *Features:* • Hi energy coil output at high RPM, • Separate Tacho output • Fixed 0.9 ms spark duration, • Coil primary voltage limited to 300V & coil current limited when fully charged, •400mV RMS reluctor circuit sensitivity, • 4-22V operating voltage, • Suits ignition systems with points, reluctor & Hall effect

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K 5558 **$49**

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Vintage Radio

by Roger Johnson

Radios 'On the Road'

Cars have had radios as a standard fitting for nearly 30 years, and most cars of the 1950s and 60s had at least provision for a radio. Prior to that, car radios were not common, but as we'll see they certainly existed.

These days we don't have just a car radio; we have a multi-function entertainment centre with digital displays, automatic searching and the like. Thirty years ago we had transistorised AM-band radios only, and for about a decade prior to that we had the radios with a special series of valves requiring merely 12V for their anode potential, thereby eliminating the need for a separate high tension power supply.

From about 1935 to about 1956 or so, car radios operated with standard valves. The car's internal DC system was used to power the heaters, and 6.3V or 12.6V valves were chosen as applicable for a given car. The high tension voltage usually came from a vibrator power supply. In order to obviate the need for specific polarity of the input, a non-synchronous vibrator was used in conjunction with a valve rectifier.

So, just when *were* radios fitted to cars — 1935? Would you say earlier, in the case of expensive types such as Cadillac, Packard, Lincoln and Rolls-Royce?

In fact the earliest reference to a radio actually fitted to a car by the manufacturers, as standard equipment, was in 1930. Yes, the American firm of Jordan fitted radios as standard equipment to their somewhat appropriately named 'Playboy' model!

The very early cars

For those people able to afford a car *and* a radio, mobile entertainment was most likely in the form of a battery portable wireless set, which was really only much good when the car had stopped.

By 1930, the Chrysler corporation had wired their brand of cars for the provision of radio. This amounted to little more than ignition suppression, and enough space on the instrument panel (i.e. the 'dashboard') for provision of the dial mechanism and controls. In other words, they were designed for a radio to be incorporated with minimum effort.

In Australia, prior to 1930, the vast majority of cars were touring cars — that is, cars with a collapsible hood made from a rubberised canvas compound. The Americans, on the other hand, produced closed cars, or sedan cars, at a much sooner date than their popularity in Australia. Why is this significant?

Fig.2: An early US advertisement for the 'Auto Pilot'. Note the speaker, the radio (on the running board) and the fact that a sedan car is shown.

It is for the simple reason of noise! Anyone who has had a ride in, or driven a vintage car, will understand what is meant. The open 'tourers' as they were called, were subject to an enormous amount of road noise — together with a barely adequate exhaust system. All this added up to a vast amount of ambient noise. It is difficult to converse with a passenger; one almost needs to shout. A closed car, or 'sedan' was much quieter by comparison, and was therefore more conducive to the installation of a radio. This is important for another reason, which we shall see.

Early installations

A search of the literature tells an amazing story. The standard procedure, it seems, was to hang a 'reproducer' (the loudspeaker) from the hood bows. The photo of Fig.1 shows a facsimile installation of an Amplion AC2, installed in a vintage car exactly as described in the early literature. In the US advertisement for the 'Auto Pilot' in Fig.2, the speaker can be seen hanging in the rear quarter-window.

However a more typical installation is shown in Fig.3, taken from the *Official Radio Service Manual 1930* as reprinted by Vestal Press of New York. As can be seen, in 1930 a section of the service manual was devoted to automobile installations. Interestingly, the diagrams of the engine components show

eight-cylinder engines. The 1930s in America were the era of the 'straight-eight' or eight cylinder in-line engines.

In the illustration in Fig.3 we see an installation not unlike cars of two decades hence. That is, the radio and speaker are mounted under the dashboard. Note the position of the car's battery. The battery was placed under the seat or under the floorboards adjacent to the passenger's feet, from those early times until almost the war years.

Power supplies

The 'B' or high-tension (HT) voltage for the valve anodes was supplied from dry batteries which were placed in a compartment under the front seat, much like the illustration, or placed in a home-made timber battery box mounted on the running board. Another possibility was to house the batteries in the luggage 'trunk', or to make a compartment beneath the rear seat.

In the early 30s the use of external dry batteries gave way to 'genemotors' — that is, a DC motor driven from the car's internal electrics, directly coupled mechanically to a DC generator to produce the high voltage. The efficiency of such devices was 50 - 60%.

By the mid to later 1930s, the genemotor gave way to the vibrator power supply. (Vibrators and vibrator-powered radios will be the subject of future articles). That same type of HT power supply was in vogue right up until about the late 1950s, when the newly designed low potential valves were used.

As far as ignition suppression is concerned, there is little departure from the standard techniques employed up until about 25 years ago, when practically all cars had distributor-and-points ignition systems in conjunction with the 'coil' (really a transformer). That is, a suppressor resistor of about 15k in each of the high tension leads from the distributor to the spark plugs, and a capacitor from the battery terminal of the coil to ground.

A small amount of energy from the high voltage winding is induced in the low voltage coil winding during the sparking process. This causes small spikes to appear in the car's electrical system, which then appear at the heaters of the valves, causing the familiar interference. The capacitor bypasses these spikes to ground.

Fig.1: This was the recommended practice for fitting the speaker in early car radio installations.

Antenna systems

From the port-war era to the 1970s, car radios used the familiar telescopic vertical antenna which was generally mounted on the front fender. Prior to that, there were any number of weird and wonderful devices.

To understand how some of these systems worked, we must first understand a little about how cars were built. Up until about 1930-2, practically all car bodies — particularly Australian made ones — consisted of a timber frame (yes, timber!), over which was nailed the sheet metal 'skin'. This technique was applied to the doors as well.

Even so, there was generally a patch in the roof which was not metal covered, but rather covered with the rubberised canvas compound previously referred to. Even when car bodies were made of all metal, and the timber framework was almost entirely eliminated, the patch in the roof still existed as before. It was not until 1937, when new sophisticated presses had been developed, that the 'all metal' car body as we know it today finally arrived.

How does this history lesson relate to antenna systems? The antenna was often simply installed in the 'roof timbers', between the

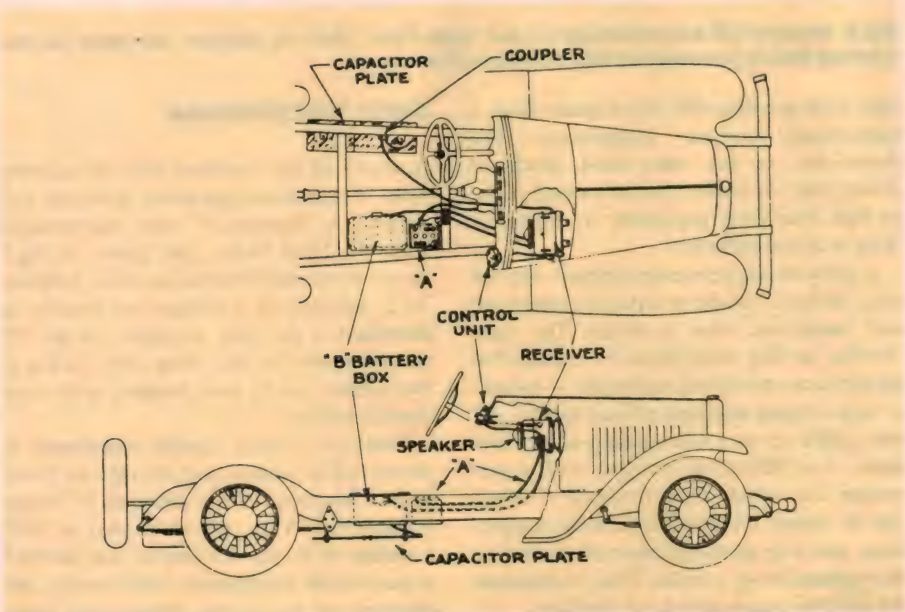


Fig.3: Diagrams for installing radios in cars in the early 30s.

head lining and the outer fabric covering!

Until 1938, most cars had running boards, and another method was to string the antenna wire underneath the running board; but this system had its obvious drawbacks.

Another weird and wonderful system was to somehow secure a small mast, about 12" (30cm) in height, on the roof adjacent to the apex of the front windscreen — and then trail two antenna wires from the top of this little mast back to the end of the roof gutter on each side of the car. The result was a 'V' antenna.

One of the more popular systems was to mount a fixed rod on standoff rubber insulators vertically on the cowl.

The 'Auto Pilot'

One of the first commercially built car radios was made by the American 'Pilot Radio and Tube Corp' — the same company who developed the successful 'Super Wasp' short wave radios. Not surprisingly, it is called the 'Auto Pilot'.

This radio was developed in 1930 as a kit set, housed in a sturdy metal cabinet for mounting to the running board of a car, and with remote controls for mounting conveniently inside the car. The speaker is as previously described, and the high tension voltage is obtained from 135 volt bank of dry batteries conveniently located elsewhere in the car. The circuit is shown in Fig.4.

As you can see, it is a TRF set comprising four type P224A's, a type P227 driver and a type P245 triode output. All tubes are 'Pilotrons' — of course — and there are no prizes for guessing the equivalent types!

The circuit is unbelievably simple, comprising the tuning components, two block capacitors and only seven other fixed components. Volume control is effected by varying the screen voltage of the RF amplifiers. The screen potential of the anode-bend detector is tied to the type 227 cathode, thus placing it at about 4 - 5V.

Another curiosity of this circuit is the inclusion of a grid bias battery in the cathode circuit of the first three RF amplifiers. Whilst this allows for the full high tension to be applied between anode and cathode, one wonders if a mere 1.5 extra volts in a 135 volt supply is going to make one scrap of difference. Surely a cathode resistor and bypass capacitor would have been more convenient?

The grid bias battery for the 245 output valve was also housed inside the case. Total HT drain is stated at 20mA, which is hefty enough even for large capacity batteries.

Finally, we come to the heater circuit, where the valves are connected in a series-parallel network across the accumulator.

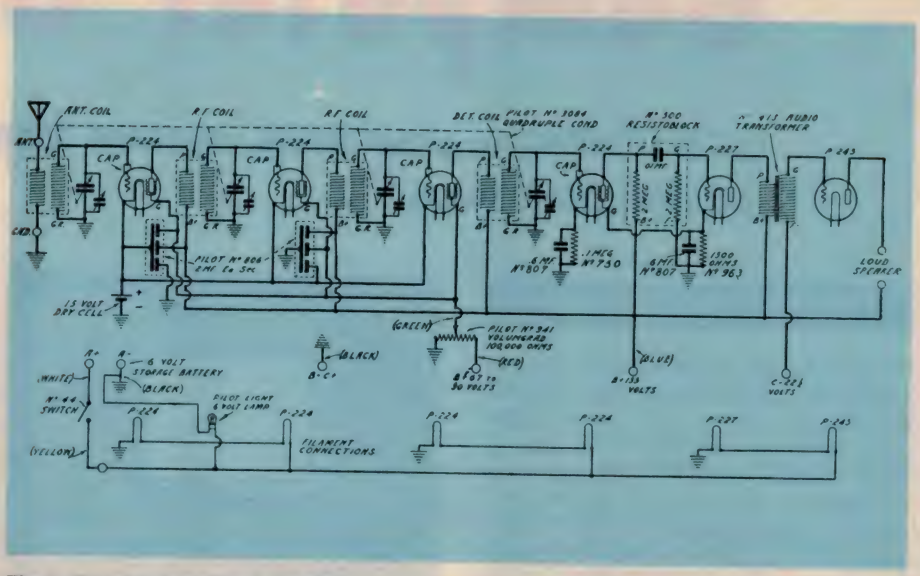


Fig.4: The circuit of the Auto-Pilot.

Important Notice

For your own safety and the safety of other drivers, we strongly recommend that you use your automobile radio receiver only when the car is stationary. With road conditions the way they usually are, you should concentrate on driving, and you should not have your attention distracted by musical programs or talks while the car is in motion. For this reason, no provisions have been made in the Pilot "Auto Radio" for the suppression of interference from the ignition system. To prevent a wave of accidents, it is likely that State legislatures will make radio-ing-while-you-drive illegal.

Fig.5: A warning by John Geloso, Pilot's chief engineer at the time.

Now a 6V accumulator undergoing charge will read up to 7V across the terminals, which means that the heaters would be driven at 3.5 volts instead of the rated 2.5 volts — far too hard for reliable life.

Why then did they do it this way? Simple; the radio wasn't supposed to be operated while the car was being driven! A 6V accumulator under this sort of load in a discharging state will probably read about 5.8V across the terminals, which means the heaters are being driven at a more sedate 2.7 volts, allowing for a fraction of a voltage drop within the wiring.

There is no doubt that this circuit would be quite selective and sensitive as well. It would need to be.

What was the antenna for an Auto-Pilot? Wait for this: a piece of wire strung between the front and rear axles! Audio output would have only been about half a watt, and the recommended speaker, available as an add-on extra, measuring 8-7/8" diameter and 3-3/4" thick, was said to be 'designed especially for the job'.

Most of this material about the Auto Pilot came from a somewhat obscure publication called *Radio Design — Official Organ of the Radio International Guild*. The description and coverage is quite comprehensive. I wonder if there are any of these particular sets in Australia?

In future articles we'll look at the superhet car radios powered by genemotors and vibrators. ❖

Computer Clinic

VESA DPMS in your BIOS, system icons and unique filenames

Save your screen!

I've just bought a new monitor that has Intelligent Power Management, but the manual states that I need to have a video card, BIOS or software utility that is VESA DPMS compliant. I found some references to DPMS in my BIOS, but I couldn't make much sense of it. What is VESA DPMS, and how can I best utilise the power management features of my monitor? (Paul van Pinxteren, by email.)

DPMS stands for Display Power Management Signalling, a standard put out by VESA (the Video Electronics Standards Association). Basically, the DPMS standard is a protocol that allows the monitor to be shut down when the system is idle, thus greatly reducing power consumption.

Assuming that you have a reasonably modern video card, your system can instruct your video card to disable its horizontal and/or vertical sync signals, which in turn instructs your monitor to go into a low-power state. This can be handled by the BIOS, by a software utility, or both.

If you look in your BIOS settings, you should find settings to enable DPMS screen blanking, and various settings controlling how long to wait before blanking the screen, and when to wake up. The exact settings might vary from BIOS to BIOS, but generally speaking, you should aim for something like the following:

Power Management	**Max Saving**
PM Control by APM	**Yes**
Video Off Method	**V+H Sync+Blank**
Modem Use IRQ	**NA**

This will cause your screen to blank after one minute of keyboard and mouse inactivity. If one minute is a bit draconian for you, (it can make reading large amounts of text an annoying experience) set the 'Power management' setting to 'User Defined', and adjust the Doze, Standby and Suspend times to something a bit more reasonable.

Alternatively, there are a number of DPMS screensavers out there, such as the one included in UniVBE. Of course, Windows 95 users don't have to worry about all this, as Win95 has built-in power management settings. To enable power management in Windows 95: Go to Control Panel\Display\Settings, click 'Change Display Type', and ensure that the

'Monitor is Energy Star Compliant' checkbox is clicked. Then go to Screen Saver, turn on the checkboxes for 'Low power standby' and 'Shut off monitor', and adjust the times for these entries as appropriate. Click OK, and you're away!

Change that folder!

How can I change the icons that Win95 uses for things like My Computer and Recycle Bin? ('Zoltan', by email)

There are a few ways of doing this. The first, and possibly the easiest, is to get Microsoft Plus! and install Desktop Themes. This allows you to customize almost all the aspects of your desktop, including icons, background images and sounds. It's fairly expensive, though, and a long way round a short corner. If you don't mind doing a bit of registry hacking, here's what to do:

First, find your icons. These reside in .ICO files, .DLL files and even in (Windows) .EXE files. There aren't any handy dialog boxes where we're going, so have a pen and paper ready. To find an appropriate icon file, find a shortcut to a program (any program), right-click it, hit 'Properties', go to the 'Program' tab and hit 'Change Icon'. You will then be presented with a list of icons in one of the general purpose icon libraries.

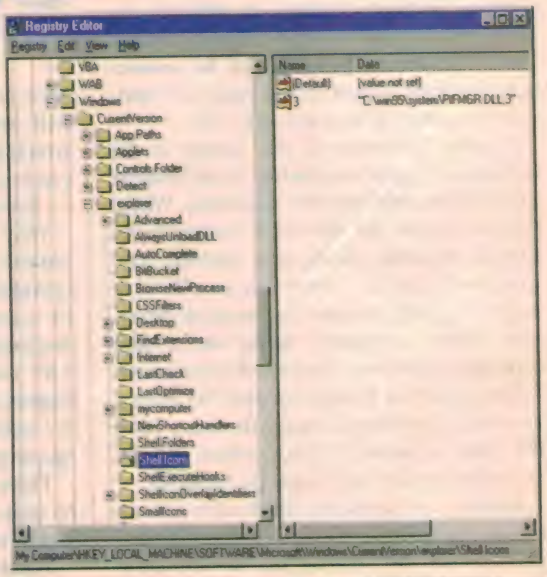
If you don't like any of the icons presented, you can hit 'Browse', and search through any of the other icon-containing files on your system. Good places to look are MORICONS.DLL and PROGMAN.EXE in the C:\WINDOWS directory, and SHELL32.DLL and PIFMGR.DLL in the C:\WINDOWS\SYSTEM directory.

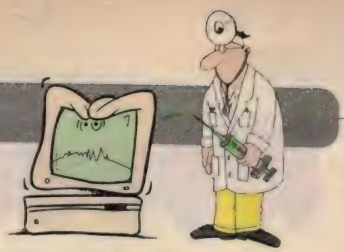
Once you've found the icon of your dreams, write down the name of the file you are using. If there's more than one icon contained in the file, you'll also need to write down the icon's place number, starting at the top left, counting from top to bottom and from left to right, starting at zero. Once you've done that, hit 'cancel' on any dialog boxes, and run REGEDIT from the Run button on the Start menu.

Before you go any further,**backup your registry!** If anything goes wrong, your computer could die in a screaming heap, and you really don't want that. There are full instructions for backing up the registry in REGEDIT's online help.

To change the My Computer icon:

Open **HKEY_CLASSES_ROOT\CLSID\{20D04FE0-3AEA-1069-A2D8-08002B30309D}\DefaultIcon**. (Regedit looks and acts a lot like Windows Explorer. Use the little '+' boxes to expand the branches of the





tree) Double click on (Default) in the right-hand pane, and in the dialog box that appears, type the full path to the icon file followed by a comma and the appropriate icon number. If the icon file contained only one icon, use zero. For example, to make My Computer look like a Ferrari, type **C:\WINDOWS\SYSTEM\PIFMGR.DLL,27**.

Once you've done that, shut everything down and restart. Vroooommmm!

To change other system icons, you just have to edit a different CLSID entry. The appropriate huge ungainly numbers for the other icons are listed below.

Inbox Icon: {00020D75-0000-0000-C000-000000000046}

Network Neighborhood: {208D2C60-3AEA-1069-A2D7-08002B30309D}

Recycle Bin: {645FF040-5081-101B-9F08-00AA002F954E} You can also change the Empty and Full icons for the Recycle Bin using the respective values in the key.

Changing the icon Win95 uses for folders can be even trickier. The simple method is to open an explorer window and go to View|Options|File types, scroll down to Folder, hit Edit, then hit Change icon. Unfortunately, for some strange reason this doesn't work on all systems. If it works for you, great. If not, it's back to REGEDIT...

Go to **HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\explorer**, and see if it contains a key called Shell Icons. If not, you'll need to create one. To create the 'Shell Icons' folder, ensure that the 'explorer' key is selected, and select Edit|New->Key from the menu. A new key (called 'New Key #1') will appear, with its name highlighted, ready to rename. Rename it to 'Shell Icons'.

Once you've done that (or if the 'Shell Icons' key already existed), select it and right-click in the right hand pane. Select New->String Value, and rename the resulting icon to '3'. (Obviously, if there is already a string value called '3', you can skip this step.) Double-click it, and enter the path to the icon you want into the dialog box that appears. Shut everything down and restart.

If you're lucky, the folder icons will have changed. If not, you need to refresh Win95's icon cache. To do this, you need TweakUI, one of the Microsoft Powertoys available free from **http://www.microsoft.com**. Run TweakUI from the Control Panel, go to the Repair page, and hit Rebuild Icons.

If all this is too much for you, there are a number of programs out there that will do everything for you. The best of the bunch is Microangelo, available from **http://www.impactsoft.com**. ❖

DOS box

Unique filenames

One need that has come up in the past is a way of generating unique filenames for data-logging projects, such as the Pocket Sampler. If you want to automate the logging process, it is necessary to find some way of passing the logging software a different filename each time it is run. This is no mean feat in DOS, as the batch file language that Microsoft came up with provides absolutely no string handling or math functions! You can't even redirect the output of the TIME command into a file. (At least, not in any useful format.) Even if you could, the resulting file wouldn't do you much good, as most DOS programs won't accept command line arguments from a file.

This finally got too annoying to live with, so I wrote a couple of little utilities that set environment variables to unique values, which can then be used on the command line as required.

The first utility is called TIMEDATE.EXE, and running it sets the environment variable TIME to the current time (HH-MM-SS), and sets DATE to the current date. (DD-MM-YY) Note that both of these variables are eight characters in length so you can use them as filenames, with any extension you like. For example: try saving the following as SAMPLE.BAT:

```
TIMEDATE.EXE
IF NOT EXIST %DATE% MD %DATE%
POCKET.EXE /F %DATE%\%TIME%.PKT
```

This will run the new improved POCKET.EXE (now available on the BBS, and also on the new EA website!) with a new filename each time, allowing you to sample repeatedly without overwriting existing files. (Note that TIMEDATE.EXE is not a TSR; when it is run, it updates TIME and DATE and then terminates. Having a variable change on you in the middle of a batch file could get confusing, to say the least...)

If you are going to be performing tasks that take significantly less than a second, the one-second resolution of TIMEDATE.EXE might not be enough. In that case, what you need is SERNUM.EXE. This nifty little utility increments the number in the environment variable SERIAL# every time it is run, thus insuring that you get a unique filename every time.

Both of these files are, of course, available on the EA BBS, and as mentioned above, our web site also.

$10 Wonders

11 — A Capacitance Gauge

Is that capacitor OK? Is it the value it says it is? Probably not, as it turns out, thanks mainly to the huge tolerance range of polyester and electrolytics (even these days). So, how do you tell what value it really is? With a capacitance gauge of course! The simple one described here is easy to build, and can measure anything from 47pF up to around 100uF.

One of the problems with electrolytic capacitors is that their capacitance is rarely close to that stated on the can. For most types, the capacitance is stated as being +/-20%, and occasionally it can swing anywhere between -10% to +30%. Added to that, a capacitor's value can vary both with age and with the amount of use, and this holds for even tantalum capacitors as well. An even higher tolerance range is found in some types of ceramic capacitor, with some sub-miniature plate capacitors having a tolerance of -20% to +80%.

On top of all this, you get the capacitors with indistinct or completely missing markings — you know the ones, the greencaps that lose their markings after they've been kept in the spares box for too long. (If you look at some surface-mount devices, you will probably have seen tiny chip capacitors which have no value marking at all!)

As you can see, there is a need for a way of measuring the value of capacitors, and that's where this little project comes in. It doesn't measure capacitance directly, but by the effect it has on the operation of an oscillating circuit. Once again, we rely on the perennial favourite, the 555 timer which you can see in Fig.1. We're using the CMOS version (known as a 7555 or TL555CP) in this circuit, as the timing will be more accurate, as well as the circuit consuming less current.

Having to solder the test capacitor onto the board each time would be inconvenient to say the least; instead we'll use a pair of alligator clips, which will handle almost any type of capacitor instead of trying to mount some kind of socket on the board.

Maths alert!

Never fear, it's not that bad. But we'll go through all the maths and I promise you that it will all work out in the end...

The output of the capacitance gauge is a single LED which flashes on and off at a rate dependent upon the value of the capacitor. The tricky bit is calculating the component values to use so that the reading is easy to interpret.

The frequency of a 555 timer is given by the equation: $f = 1.44/((R1+(2*R2))*C)$. If R1 = 1M and R2 = 220k, the expression in brackets becomes 1.44×10^{-6}. So the 1.44s cancel out and the equation simplifies to $f = 1/(C \times 10^{-6})$.

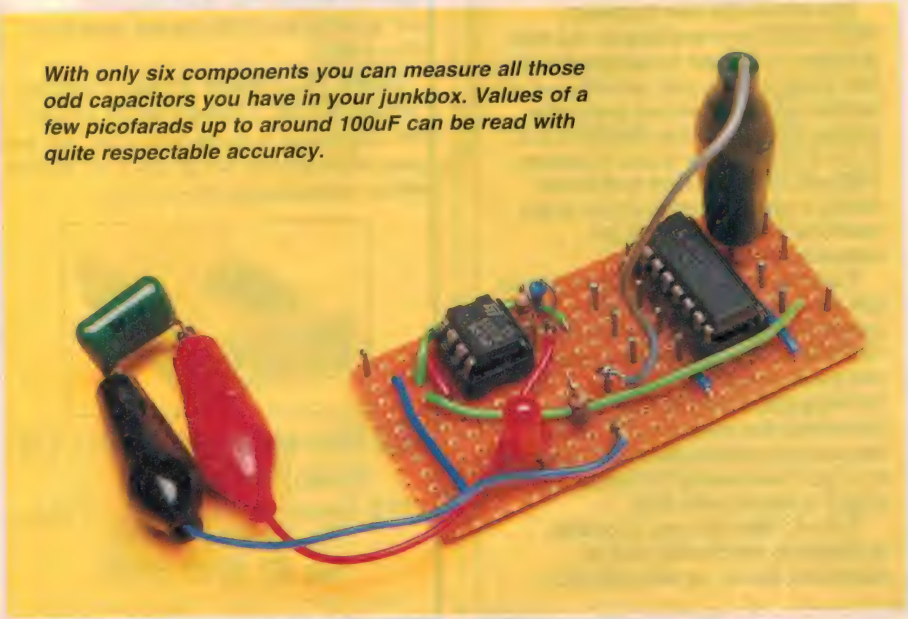
As we shall be measuring the *period* of one cycle of the output (where T = 1/f), the equation becomes $T = C \times 10^{-6}$. Putting it into words, the length of the period in seconds equals the capacitance in microfarads. What could be simpler?

There's no real problem in measuring electrolytics and tantalum capacitors, as these have capacitances up in the microfarad region. A good example would be a capacitor with a nominal value of 47uF. This would give about a period of about 47s, which is easy to measure with an ordinary watch or clock.

The difficulty arises with greencaps and other capacitors which are typically less than 1uF. Precise measurement of times less than one second isn't easy with a watch, and so one way around this is to measure, say, 10 cycles. Measure the total time while counting 10 'ons' and 10 'offs', divide the time by 10, and you have your answer. For smaller capacitances (e.g., 33nF), we can

Stage	Divided by
1	2
4	16
5	32
6	64
7	128
8	256
9	512
10	1024
11	2048
12	4096
13	8192
14	16384

Fig.2



With only six components you can measure all those odd capacitors you have in your junkbox. Values of a few picofarads up to around 100uF can be read with quite respectable accuracy.

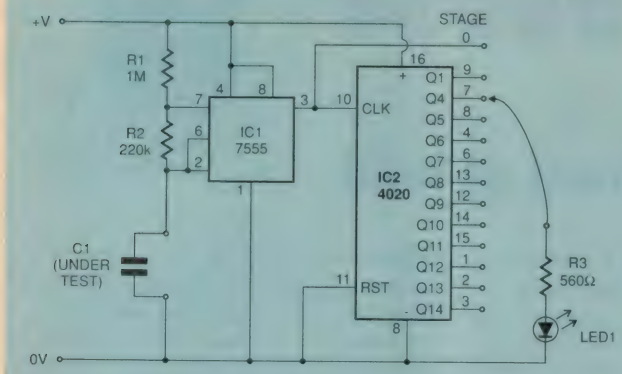


Fig.1: The rate of the 7555 oscillator is directly the capacitance of C1. With the LED connected to the '0' point, it will flash at the rate of one microfarad per second.

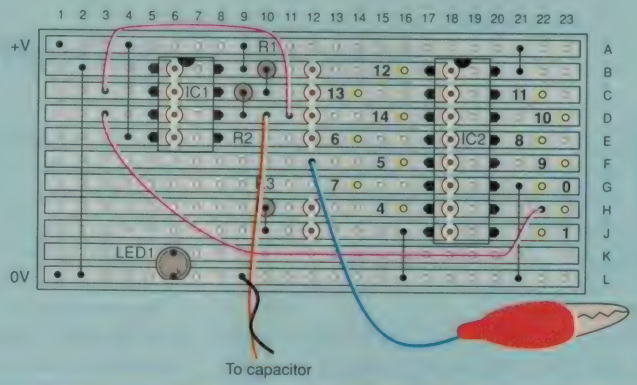


Fig.3: The stripboard overlay. Use a red wire and clip for the lead going to pin 6 of IC1, as electrolytic and tantalum capacitors need to be connected the right way round to be measured.

use a CMOS 4020 to help slow things down.

IC2 in the circuit is a 4020 14-stage divider and it has no outputs from stages 2 and 3, which can be a nuisance; but it's something we will put up with in order to keep the project within the $10 budget. The LED has a flying lead, which can be clipped to any one of the 12 outputs of the divider, and the frequency division obtained at each stage is shown in Fig.2.

To see how to use the divider, take a look at this example: if the LED is connected to the output of stage 8, the LED flashes at only 1/256 the rate at which the timer is running. (Putting it the other way around, the period of the flashing is 256 times longer than the period of the timer.) So if we measure the period when a given capacitor is being tested, and find that the period is 15s, the capacitance in microfarads is given by: C = period/divider = 15/256 = 0.0586uF. You could then convert the units and say the capacitance is 58.6 nanofarads, which is a little more conventional.

Another example: the period is 27s when measured with a different capacitor in the clips, and with the LED connected to output 12 (divider = 4096). The capacitance here is 27/4096 = 0.00659uF = 6.6nF.

Accuracy

If we use 1% tolerance resistors, the timing period produced by the 555 is of a similar order of accuracy. One of the useful features of the 555 is that the period is independent of supply voltage. It doesn't matter if you use a 6V or 9V battery, or even if the battery is going flat. This is because the timer works on the principle of charging the capacitor up from exactly V/3 to exactly 2V/3 before discharging it again. (Where V is the supply voltage being used.)

During one charging cycle, the capacitor's voltage increases by V/3. The charge fed into the capacitor to do this is Q = CV/3. If V is a little flat, the capacitor does not need as much charge to take it up to 2V/3, but as V is lower as well, less current flows through R1 to charge it. The two factors cancel out exactly, making charging and discharging times independent of V.

So where is the capacitance gauge inaccurate? In three main areas:

- Leakage through the capacitor: Electrolytic capacitors have relatively high leakage, especially those of a high value, as well as those that are old or haven't been used for some time. Consequently, capacitances greater than about 100uF are usually overestimated by the circuit.
- Stray capacitance in the circuit: There is capacitance within the IC, between the copper strips on the stripboard, between the leads to the crocodile clips, as well as stray capacitance due to long leads on the capacitor being tested. If the result of your test is in the order of tens of picofarads, it is best to try running the circuit with no capacitor connected at all, and with the LED flying lead clipped to output 14. You will probably have to time 10 or more periods by counting flashes, but this will give you an estimate of stray capacitance (our prototype was 26pF) to subtract from other readings.
- Timing errors: Timing by eye and hand introduces human reaction time into the measurement, but this need not be serious. If you start timing as the LED comes on, and stop the next time it comes on, you are adding approximately the same reaction time to both the start and the stop times. Their *difference* is relatively unaffected by reaction time. Another point is that the longer the period, the relatively smaller the timing errors. Choose a divider output that gives a period of at least 10s, preferably around 100s.

Construction

Construction is very simple, and if you've built up any of the previous $10 Wonders, you shouldn't have any problems — there are only six components on the board! Fig.3 shows the stripboard layout, and note that some of the strips are cut beneath the board.

Make the leads for the crocodile clips to C1 are as short as practical, as you want as little stray capacitance as possible. Also make sure that the red clip goes to pin 6 of the 7555, with the black one going to ground. As mentioned above, the circuit can be powered off 9V or 6V, and an on/off switch would be a good idea as well.

For testing, clip a 10uF capacitor in the leads (remember to observe correct polarity if it is an electrolytic or tantalum capacitor). Connect the flying LED lead to the '0' pin, to monitor the timer output directly, and the LED should flash on and off every 10 seconds. Connected to pin 1, it flashes on and off every 20 seconds. For checking the later stages, use a capacitor of known smaller value, and check that the timings are as expected. ❖

Parts List

Resistors

R1	1M (1%)
R2	220k (1%)
R3	560 ohms (can be 5% tolerance)

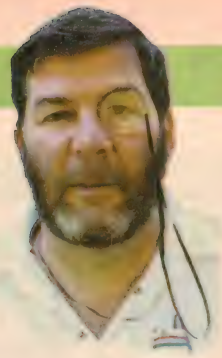
Semiconductors

IC1	7555 or TL555CP CMOS timer IC
IC2	4020 CMOS 14 stage ripple counter divider
LED1	Light emitting diode

Miscellaneous

Stripboard 30mm x 60mm (11 strips x 23 holes); 17 x terminal pins; 8 pin DIL socket; 16 pin DIL socket; crocodile clips (red, black, green); battery clip or holder.

Moffat's Madhouse



Internet Exploder tamed at last!

This is the latest, and possibly last, adventure in the on-going series 'Moffat's Madhouse Takes On Internet Exploder'. The tale involves an epic struggle between Computer Techie and *The Software That Just Wouldn't Go Away*. But let us start at the beginning...

Hark back to the April issue of *EA*, and my Moffat's Madhouse column entitled 'Defusing Internet Exploder'. This was written around the beginning of this year, while there was a monumental power struggle taking place between the US Justice Department and the mighty Microsoft Corporation. At issue was Microsoft's practice of forcing their Internet Explorer program into every computer that used Windows 95, whether the owner, or computer maker, wanted it or not.

Microsoft claimed, in a court of law, that it was impossible for Windows 95 to run unless Internet Explorer were installed. This was because MSIE was tightly integrated into the Windows 95 system (read 'takes over'), so that every window in the system looked like an internet web page, complete with the IE logo.

It seems that there are many people who would prefer to use a web browser other than Internet Explorer. Sometimes this is really a political statement: Install Netscape, and rub Microsoft's nose in it. Other users worry about dedicating a whole slab of megabytes to one software application, especially if their hard disk is of less than brand-new vintage. Anyhow, there's been a strong movement out there — Exploder's gotta go.

In April we described a four-step plan for foolproof removal of Internet Explorer, involving some rather brutal hacking: enable CD-ROM independently of Windows, chop out Explorer, chop out Windows, reinstall Windows from the CD-ROM. Around the time the article was written, the four-step plan worked very well, and I used it several times a week to nobble Internet Explorer in various computers...

One day one of my clients decided to abandon his old Windows 3.1 computer, mostly because the hard drive was screeching loudly whenever he turned it on, and the computer wouldn't boot. A brand-new Compaq was duly ordered, from one of the mail-order houses. The buyer was told there would be a two-week wait as more machines were made by the factory. At least his new Compaq would be guaranteed factory-fresh.

The day the computer arrived I gave my client the usual advice: you can unpack it if you want, but don't turn it on until I get there. This was so I could monitor, and possibly prevent, any attempts by the computer to install Internet Explorer into itself without permission. I was hoping to see some message such as 'Install Internet Explorer 4.0? Yes/No'. Dream on... it's never happened yet.

The computer went through the usual routine, asking for the user's name and the serial number of his copy of Windows, and eventually it displayed the Windows desktop. No indication at all that Internet Explorer had moved in. Maybe we were getting lucky! Time to start the internet setup...

My usual practice is to begin by testing the modem, and then work backwards through Networking and Dial-Up Adapter, and on to the browser. In this case, there were two of them: Opera, and the dreaded Netscape. Rub Microsoft's nose in it twice!

Sometimes Tom *is* a silly boy. Why didn't I think of this in the first place? Too prejudiced, I guess, against the old ways of Microsoft and their un-uninstallable software. But now... here was this tempting Internet Explorer entry, just begging to be clicked on...

This means WAR!

So I opened the Windows 95 Control Panel, and then — AND THEN — holy cow Batman, the Control Panel window was showing the Internet Explorer logo. They'd slipped MSIE right past us! This was WAR!

"Get your program disks!", I told the owner. "We're gonna reinstall!"

What program disks? The Compaq had come with only one, a bright red CD-ROM labelled 'restore disk'. No Microsoft Works, no Quicken, and most importantly, no Windows 95 CD-ROM.

An inspection of the directory structure of the restore disk revealed that some of it wasn't a directory structure at all. Just garble on the screen. And there wasn't even that familiar WIN95\ directory which contains all those .CAB files that make up the yet-to-be installed Windows 95. What to do?

It became evident that the restore disk wasn't just a collection of uninstalled software files. It was more likely a simple image of a portion of the hard disk, a direct copy of the installed and working software. Copying this disk into the computer would restore everything, installed and working, just as it came out of the factory. This is really a very easy way for an inexperienced user to start again if he messes everything up, but it lacks the ability to install individual programs.

So the decision was made to hack out the whole Internet Explorer directory, but leave the Windows directory intact so the application software would remain installed. Then we could use my own Windows 95 CD-ROM to load a fresh copy of Win95 on a 'maintenance' basis, replacing only files that were missing or corrupted by the presence of Internet Explorer. This would be perfectly legal since the owner had his own Win95 serial number which would be entered at the appropriate time.

Onward we marched. One of my CD-ROM boot disks brought the CD-ROM drive to life, independently of Windows, So I stuck my own Win95 disk into the CD-ROM and typed 'setup'. We were away! But not for long.

The Windows 95 installation got to a certain point and just stopped. And when I removed the boot floppy and CD-ROM and restarted the computer, it would progress no further than the MS-DOS on the hard disk, displaying a **C:>** prompt. No Windows at all. Curses — foiled again!

So, amidst much wound licking, we fed the computer its 'restore disk' CD-ROM and waited as it slowly rebuilt the hard drive contents, erasing the whole morning's hard work. After that there was no choice but to accept the fact that Internet Explorer was there, in control, and it was going to stay

there. I went ahead and got the internet going, and then slunk home, tail between my legs, defeated... deflated... exploded by MSIE...

Then I started to think: Didn't Microsoft eventually agree to supply Windows without Internet Explorer? Well, with this latest model Compaq, it looks like MSIE is entrenched in there more firmly than ever. Have Microsoft defied the Justice Department? Why aren't they in jail?

And then I recalled what I remembered as the wording of the court's decision: Microsoft could continue to supply MSIE with every copy of Windows, but they would give the computer owner the option of removing it. Hmmmm — an idea was forming.

The rumours spread...

I phoned the Compaq's owner and told him I had another idea for ridding him of Internet Explorer. Could I come over and have another go? No, he said, he was going to be out for the next two days, but perhaps I could try it the following night. Agreed.

And as I waited, I started hearing the rumours around town — from other clients and somebody who knows somebody. "Tom Moffat is going to remove Internet Exploder from Greg's new Compaq". It's almost as if I said I was going to cruise down the main street in a flying saucer. The populace looked upon the prospect with considerable wonderment. This had better work!

It was a pretty simple idea, really. Windows 95 has always had a feature in Control Panel called Add/Remove Programs. Truly civilized software applications arrange for their names to be put in a list within this window. You can click on the name, and the program in question is gracefully removed. Registry cleaned up, everything. No hacking required.

Since the early days of Windows 95, the name 'Microsoft' has been somewhat scarce in the remove list. Most of their internet applications have been one-way only: once they're installed, they're there to stay. But in this new Compaq, in the Control Panel remove list, the Microsoft name was everywhere. And at the top of the list — 'Microsoft Internet Explorer Version 4.0'. You could remove various internet components, or the whole works.

Sometimes Tom *is* a silly boy. Why didn't I think of this in the first place? Too prejudiced, I guess, against the old ways of Microsoft and their un-uninstallable software. But now... here was this tempting Internet Explorer entry, just begging to be clicked on.

Click-click! 'Do you want to remove Internet Explorer?' YES!

'And all its components?' OH, YES, YES!!!

Much disk spinning, flies flipping across the little screen, deleting this, deleting that, GOODBYE Internet Exploder and GOODBYE Outlook and GOODBYE Messaging and other various MS-Dross. The computer is CLEAN! REBORN! (*I hope...*)

At long last, it wants to restart — 'so the new settings can take effect'. Let us hope it has replaced the Windows kernel that was so rudely commandeered by Internet Explorer. Otherwise there will be no Windows, and we'll be back on that MS-DOS C:> prompt again. And back to the red restore disk.

After a couple of lusty beeps and 'the Microsoft sound', we had a desktop again. But it was still not the colours of the original Windows — was Explorer still lurking somewhere? Try Control Panel. Hah! No Explorer logo. No Explorer icon either. Mission accomplished. Actually those new colours looked rather nice, subtle brownish pastels instead of the light blue/dark blue/gray of traditional Windows. All those old colours are displayable on a 16-colour monitor, but nowadays, with 16 million colours, Windows can be more creative...

This whole affair raises one big question: Back during the court proceedings, Microsoft swore up and down that Windows 95 would never work unless Explorer was present too. Now they allow users to remove Explorer, and Windows still works. Did Microsoft lie to the court? Were they in contempt?

Maybe now is the time to drop the argument. What's done is done, it's all over. What was, for all intents and purposes, a Trojan horse is now a civilized software application, holding no unfair advantage over other applications such as Netscape and Opera which perform the same functions in different ways.

Thus, I guess Microsoft now deserves our respect with Explorer. People are constantly asking me if they should be using it. Now that it *can* be gracefully removed, why not try out MSIE? If you don't like it, you can heave it, just as with any other software application. I have often been accused of Microsoft bashing, but my gripe has not been with any particular software, so much as the fact that the software has been *compulsory*.

I don't ever see Internet Explorer ending up in my own computer, for purely practical reasons. It's an older laptop, with an 800 meg hard disk and 16 megs of RAM, and a 75MHz Pentium. Not enough muscle to do a decent job with the likes of MSIE. But for those of you with a computer such as that flashy new Compaq (and it is a wonderful machine) — go for it! ❖

DSE kits for popular EA projects

by Jim Rowe

Recently we were able to examine assembled Dick Smith Electronics kits for two of our more popular recent projects: the Video Enhancer/Stabiliser of November 1997 and the 'Four-In-One' Mini Bench Supply of January 1998. I was also able to put together one of their kits for the incredibly successful ESR & Low Ohms Meter, of February 1996. Here's what we found...

When we and our contributors design DIY projects for description in the magazine, we put quite a lot of effort into trying to make them easy to build and get going. Despite this, it isn't easy to predict which projects will actually end up appealing to the largest number of people. Sometimes the projects we're expecting to be popular aren't, for some reason, while others surprise us by being much more popular than we would have predicted.

Of course those projects which are supported by at least one of the major kit marketing firms have the best chance of becoming a 'success', because people can then be assured (generally) of having all of the necessary parts. That's why we're always delighted when firms like Dick Smith Electronics decide to support one of our projects — we know it then stands a much better chance of being built successfully by anyone with an interest in doing so.

All of which is by way of preamble to this quick look at three of DSE's kits for recent *EA* projects — whose popularity they no doubt helped ensure. Two of them are my own Video Enhancer/Stabiliser of November 1997, and the Four-in-One Mini Bench Supply, of January this year; the third is Bob Parker's vastly popular ESR & Low Ohms Meter, of January 1996.

A couple of weeks ago we were able to check out completely assembled kits for the first two, while my own recent need for one of Bob Parker's ESR meters also gave me an opportunity to get direct 'hands on' experience assembling the DSE kit for this project as well. Here's what I found in each case.

ESR meter

I understand that Bob Parker's ESR and Low Resistance Meter design has been extremely popular, with many thousands of kits being sold — not just within Australia, but to many other countries as well. Presumably that's because it's not just a very well designed instrument, but also happens to provide a relatively low cost and easy-to-use way of measuring something that's otherwise very hard to measure. It may not be the kind of unit needed by *everyone* in electronics, but I suspect just about every service technician in the country has built one or is planning to.

When we published Bob's article back in the January 1996 issue, I was so impressed that I intended to build one for myself. But other things intervened, and time slipped by. It was only a couple of weeks ago that I was trying to do some troubleshooting in a switch-mode supply, and realised that I really *needed* an ESR meter to check the electrolytics. So before I was side-tracked again, I decided to get a kit and put it together. (By the way, it can also be used to check NiCad batteries, as Phil Allison has pointed out — see our May issue.)

As luck would have it, the nice people from DSE's kit department heard what I wanted to do, and the next thing I knew they'd sent one of their kits for me to do a 'hands-on evaluation'. Thanks, guys!

Anyway, the kit was complete, with everything I needed except a 9V battery — reasonable enough. The front panel is from 1mm-thick mild steel plate, with all holes cleanly pre-punched. It's powder coated in

black, with the legends (including Bob's guide chart) silk screened in white. A particularly nice touch was that the small rectangle of red perspex for the display filter is pre-cut to size, with a rebate milled around all edges so that it fits snugly in the cutout from the rear. (All I had to do, at the appropriate time, was carefully scrape some of the paint from the edges of the hole, because it was a whisker *too* snug!)

Other welcome touches are a small coil of resin-cored solder, and a set of plugs, shrouded crocodile clips and wire to make up the meter's test leads.

As before, all of the parts supplied were of good quality, and of course the microcontroller chip was supplied in pre-programmed form. The end result was that it all went together smoothly, quickly and without trauma. A few hours later I was going through the setup procedure, which was again without incident. So now I too have been able to join the ranks of enthusiastic Bob Parker ESR Meter users, thanks to DSE's very nicely turned-out kit...

So I'm happy to recommend the K-7204 ESR & Low Resistance Meter kit, which apparently still sells for only $59.95 — excellent value for money, surely.

Video Enhancer

DSE's kit for the new Video Enhancer proved to be made up of really good quality parts, which had been assembled to make up a much more professional-looking unit than my original hand-crafted prototype. The front and rear panels are made from sturdy 2mm thick aluminium, with all holes neatly pre-punched and the legends cleanly silk screened on the powder-coated finish.

The internal shield/mounting plate for the power transformer and PCB assembly is of zinc-plated steel, with nylon standoffs for mounting the PCB. Good quality sockets are provided for all of the DIL-package ICs, and there's also a bezel for mounting the LED in the front panel. Another nice touch is the supply of insulated single-hole mounting BNC connectors for the video input and output, to minimise hum loop problems.

The only significant difference between DSE's kit and the project as originally described is in connection with the mains entry. Instead of using a captive IEC mains plug on the rear panel, the kit uses a captive mains cord which enters the rear panel via a clamping grommet and is terminated in a B-B connector strip. Needless to say all necessary parts are supplied, including the cord with moulded-on three-pin plug, making a safe and entirely acceptable alternative arrangement.

Overall, then, the K-5411 Video Enhancer & Stabiliser kit seems very good value for money at the advertised price of $69.00.

Four-in-one supply

The DSE kit for the Four-In-One Mini Bench Supply is also quite impressive. In this case both front and rear panels are made from strong 2mm thick mild steel sheet, with all holes pre-punched as before and then powder-coated in a charcoal grey. The front panel legends are cleanly silk screened in white, and give the finished supply a very professional appearance.

Inside, it's clear that all parts used are of good quality, and allow construction of a very safe and reliable supply. A nice 'extra touch' is that a piece of 'elephant hide' sheet is included in the kit, to allow fitting as a safety barrier between the mains wiring and the main PCB assembly. Seven nylon cable ties are also provided, to bind both the mains wiring and off-board low voltage wiring together, and make sure the two can never come into contact.

Again the only significant departure from the original project is with the mains entry, with a captive mains cord/clamp grommet/B-B strip connector used in place of the original IEC plug. But this is again quite acceptable and safe, especially as a piece of large-diameter heatshrink tubing is provided to cover the entire fuseholder and prevent accidental contact.

So again, the K-3213 Mini Bench Supply kit provides an excellent way to realise this project, and seems good value for money at the advertised price of $59.95.

You should be able to find all of the above kits at any of the Dick Smith Electronics outlets, and of course they're also available through the Company's mail order service. For more information check in their monthly ads, or in their new catalog, accompanying this issue. ❖

Electronics Australia is one of the longest-running technical magazines in the world. We started as *Wireless Weekly* in August 1922 and became *Radio and Hobbies in Australia* in April 1939. The title was changed to *Radio, Television and Hobbies* in February 1955 and finally, to *Electronics Australia* in April 1965. Here's some interesting items from past issues:

50 years ago

June 1948

Ultrasonic Thickness Gauge: A new ultrasonic thickness gauge has been released in the USA by Branson Instruments Inc. The instrument contains a variable frequency oscillator, the output of which is itself frequency modulated by a small increment. The output excites an X-cur crystal, which is placed in contact with the surface to be measured and coupled to it by a fine oil film.

Reflections occur from the inner surface of the metal, and standing waves appear at the fundamental and all harmonics of the frequency whose wavelength in the metal corresponds with the thickness. The device is arranged so that an audible note is produced in the phones when resonance occurs.

Television in the USA: Television's forward surge in the last six months was made possible by more than 20 years of research and hard work in the radio industry, at a total cost of more than 50 million dollars, reports our New York correspondent.

In the New York area, video programmes can be tuned in seven evenings a week, with brief periods on a few days at noon and again in the late afternoon — an average of 22 hours weekly, compared with the 18 hours daily of sound broadcasting.

25 years ago

June 1973

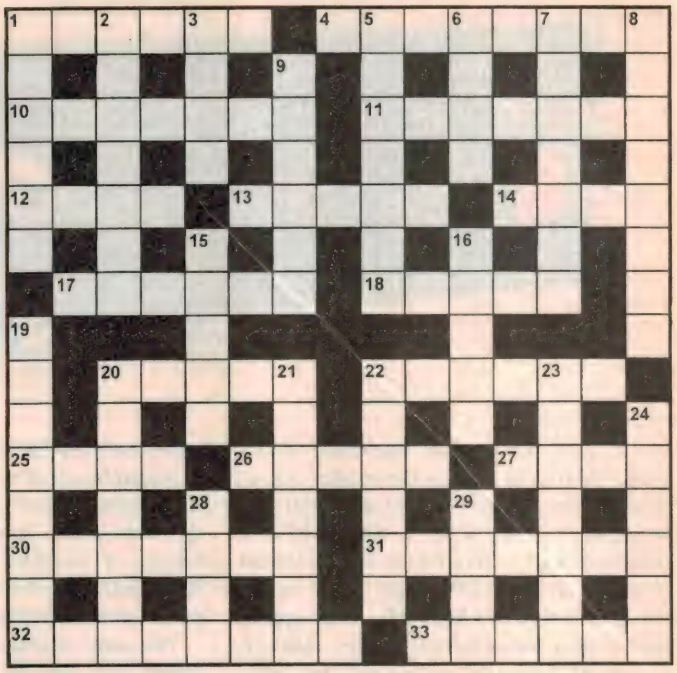
CSIRO Develops New Landing System: A new microwave landing system for airports has been developed by scientists at the CSIRO, working in conjunction with the Department of Civil Aviation. The system is based on an original Australian idea, and uses electronically scanned antenna arrays to permit curved flight paths and a variety of approach angles. It thus provides considerable improvement over the existing VHF instrument landing aid systems in use, which allow only for virtually fixed azimuth and approach angle.

Known as 'Interscan', the new system is to be submitted to the International Civil Aviation Organisation (ICAO) for consideration as the new system to be adopted for world-wide use.

Record Australia-US Contact on 1296MHz: A few weeks ago, on February 19, Australian radio amateur Ron Wilkinson VK3AKC became the first to contact America on 1296MHz, using moonbounce. It was his first attempt to achieve this historic contact, which was made possible by data supplied by the US Naval Research Laboratory.

Ron's remarkable earth-moon-earth shot was achieved at his home in Newtown, a suburb of Geelong. Contact was maintained for a full 45 minutes, until the moon moved out of position. ❖

Crossword



Across

1 Operates a mouse button. (6)
4 Brings to a better standard. (8)
10 Kind of bias. (7)
11 Covering pattern. (7)
12 Antenna type: rabbit .... (4)
13 Communication device. (5)
14 Brand of TV of European origin. (4)
17 Physical quantity with direction. (6)
18 AF feature of phone keypad. (5)
20 Erase. (5)
22 Set rocket in flight. (6)
25 What you need for this space! (4)
26 Interferential sound. (5)
27 Developer of supercomputers. (4)
30 Said of material which dissipates less energy. (3-4)
31 Rubber fitting on camcorders, etc. (7)
32 Central part of IBM. (8)
33 Integrated assemblage. (6)

Down

1 Units of radioactivity. (6)
2 An operation of opposite kind. (7)
3 Name of effect in epitaxial power transistors. (4)
5 Prevent damage. (7)
6 Prefix indicating current. (4)
7 Currency units. (7)
8 Radio transmissions reflected by the ionosphere. (8)
9 Fix a fault. (6)
15 Place in memory. (5)
16 Form of original film. (5)
19 Orbital research laboratory. (8)
20 Loud, harsh noises. (7)
21 Searches through indexes, etc. (7)
22 Name of effect produced by recombination of charge carriers. (6)
23 Group of components. (7)
24 Selenite. (6)
28 Given name of Bardeen, of transistor fame. (4)
29 Name of signalling pistol. (4) ❖

May's solution:

E	L	E	C	T	R	O	N	I	C	S		D	V	M
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P	A	I	R		T	W	I	C	E		A	U	T	O
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Electronics Australia's

Professional Electronics

Melbourne firm ITG develops leading-edge dynamic vehicle testing system for Holden

Microsoft & Intel to integrate TV & PC technology...

Test & Measuring Feature: DMMs & current clamps from CIE offer value, quality

Cryptography: Why it's become a matter of politics

Hewlett-Packard Company's new HP 16700A: a modular high-performance digital system debug tool which combines logic analysis with emulation. Can capture 1020 channels, 4GSa/s timing, or generate 200MHz patterns on 200 channels...

(See page 87)

highlights News

Local firm's advanced vehicle testing system

Melbourne based Innovative Technologies Group has developed an advanced Dynamic Vehicle Testing Station (DVT) for Holden Ltd, using leading-edge technology which allows simulated driving conditions up to 200km/h on the production line. The DVT simulates actual driving conditions and monitors all aspects of a vehicle's performance, all in a space not much greater than the vehicle itself.

The DVT is being used to test all cars which come off the Holden production lines, and provides major cost savings to the company by improving vehicle quality before the vehicle leaves the manufacturing plant. Warranty claims are reduced and customer satisfaction levels are improved.

A team led by ITG's Graham Cottew (Information Technology) and Bill Hoffman (Engineering), designed and constructed the station, using the very latest in software, electrical, electronics and mechanical technology. The Holden DVT system is said to advance significantly the capabilities of dynamic vehicle testing.

"The ITG Dynamic Vehicle Testing Station is quite possibly the most advanced DVT in the world, particularly in the areas of flexibility and traction", according to Holden Senior Engineer, Tom Cawley.

The new ITG design allows all of the vehicles in the Holden range to be tested on the same station, within a drive-on to drive-off time of just two and a half minutes. As the vehicle drives onto the machine, an RF tag or barcode on the vehicle identifies the model and initiates a drive-on sequence where the DVT automatically adjusts its length to the wheelbase of the vehicle and identifies which tests must be performed. The DVT connects to the vehicle via a single plug-in connector under the dashboard, which is now a standard feature on all Holden vehicles.

In the 150 seconds the vehicle is under evaluation, the DVT performs more than 100 tests, including a thorough performance analysis of the audio and entertainment system, supplemental restraint system (airbag), anti-lock braking system, climate control system (air conditioning), smart key and security programs, the body control module (electric windows, demisters, cooling fans, dash illumination, wiper delays and lighting, etc) and the engine and transmission.

The engine and transmission testing is the most comprehensive part of the procedure. The entire engine management system is monitored and readings taken at dozens of points on items such as oxygen sensors, knock sensors, manifold pressure sensors, and gear shift times and points — during the most realistic driving conditions yet simulated on a DVT. The DVT compares this output with a set of ideal readings for such a vehicle and can pinpoint faults which would otherwise not become evident until the vehicle has done thousands of kilometres on the road.

This realistic simulation of actual driving conditions is enabled by a newly designed roller system which drives all four wheels by independent electric motors, rather than the previous two-wheel-driven DVTs which were driven by belts. Not only does this allow four wheel drive vehicles to be fully tested, but it also offers much greater flexibility of testing procedures and greatly improved traction.

The ITG DVT enables safe and thorough testing of such important features as the Anti-lock braking system and Traction control systems, as it enables wheel braking performance to be monitored under simulated driving conditions. Warranty claims have dropped dramatically since the introduction of the system and will further advance Holden's quality control, and customer safety and satisfaction.

At the heart of the fully computerized system is ITG's real-time Test Development Language, which is very similar to English and was written specifically to enable non-programmers to develop and customize complex suites of multi-tasking testing applications. Though first deployed in the DVT, the software system was developed with a wide range of applications in mind. It is claimed to be ideal for any manufacturing process, as it is capable of controlling massive complex simultaneous testing procedures while remaining user friendly enough to be used by non-skilled personnel, with minimal training.

PC Assemblies, CSSA Aust. merge

Contract electronics manufacturing firms CSSC Australia and PC Assemblies have merged, to form CEMA (Contract Electronic Manufacturers Australia). The new firm is said to combine the high technology PCB assembly expertise af PCA with CSSC's broader-based additional competencies in cable and electronic/electro-mechanical assembly, giving a synergy which offers a formidable manufacturing force to the electronics industry.

Based in CSSC's facility in Seven Hills NSW, which is currently undergoing major refurbishment, the new company now offers a sizeable PCB production capability. State of the art production equipment and procedures will ensure the market high quality PCB assembly at competitive prices, coupled with the additional services of cable and system assembly. These provide an effective and diversified base,

enabling the new company to offer an entire turn-key operation.

The combined operation has the manufacturing flexibility to offer prototyping, small runs or high volume production with rapid response. The services offered by CEMA include PCB assembly, both 'through hole' and SMD; cable assembly; full turn-key electronic/electromechanical equipment assembly; design for manufacture; in-circuit (ATE) and functional testing; burn-in facilities; conformal coating; and materials procurement.

Typical markets addressed by the merged company, whose combined customer base overlapped very little, includes IT&T; entertainment; medical; industrial control; defence; power control; automotive; and point-of-sale.

EMC Corporation of Hopkinton, Massachusetts claims to have developed the world's highest capacity disk storage system, holding six terabytes (6000GB).

Inmarsat restructuring

The Inmarsat Council, meeting in London, has reached agreement on the restructuring of Inmarsat from an inter-governmental organisation to a privatised company with a target date of January 1, 1999.

For more than three years, Inmarsat's Signatories, Parties and management have worked together to design and develop the framework for a new Inmarsat comprising: (1) a public limited company that will seek an initial public offering (IPO) within approximately two years of formation; and (2) a structure to ensure that Inmarsat meets its public service obligations, including the Global Maritime Distress and Safety System.

"The agreement we reached today is a significant event in the environment of growing competition and privatisation in satellite communications", said Inmarsat director general Warren Grace. "This complex effort is a remarkable success story for global co-operation and it will ensure that Inmarsat and its partners will continue to play a leading role in mobile satellite communications into the future."

Inmarsat is an internationally owned co-operative that provides mobile satellite communications worldwide. Established in 1979 to serve the maritime community, it has since evolved to become the only provider of global mobile satellite communications for commercial, distress and safety applications at sea, in the air and on land. It currently has over 107,000 customers.

W&G merging with Wavetek

At the recent Cebit Exhibition in Hannover, Wandel & Goltermann Management Holding GmbH of Germany and Wavetek Corporation of the USA announced that they have reached an agreement in principle to merge the companies. If the merger is approved by stockholders and regulatory agencies, it will create the world's second largest communications test company, with annual revenues in excess of US$400 million (700 million DM).

The combined company will employ over 2400 people in 11 operating units, and 29 sales and service companies, with a presence in 87 countries.

"This merger brings together two well respected companies to form a new powerhouse in the communications test business", said Peter Wagner, President and CEO at Wandel & Goltermann, "We are confident the new company will be positioned to achieve strong growth, by building upon our combined strengths and delivering real and lasting value to our customers."

"Everything about this merger is complementary", added Dr Terence Gooding, Chairman and CEO of Wavetek. "Our broad product offering, focussed direct and indirect sales channels and strong worldwide service organisations, together with our experienced management teams and international employee base, position us to be a preferred strategic partner for our customers, supporting all of their communications test needs."

Wandel & Goltermann celebrated its 75th anniversary in March this year.

Aust firm develops automatic clock system

Australian firm HPM Technologies has announced the release of what is claimed as the most advanced and innovative wireless timekeeping system in the world, which ensures that clocks are automatically kept set to the correct time regardless of daylight saving or other factors.

The TeleChron system, for which international patents are pending, uses data transmitted via a paging system to automatically adjust clocks and maintain them to within 0.25 second. It's claimed to be the first wireless clock system available for industry and businesses requiring a large number of maintenance-free clocks.

"TeleChron has repercussions at every level of our daily lives, from clocks in railway stations, airports and schools to those sites that previously could not be hooked up to accurate time, such as bus stops and process and control engineering sites", said HPM Technologies MD Robert Getreu.

The concept was first conceived in 1994 by Roger La Salle, HPM Technologies Technical and Sales Director. The first range of TeleChron clocks have been designed for the commercial and industrial markets, with a wider range for consumers to follow later this year.

A feature of the TeleChron system is that the clocks can be user selected to display time in any of 15 different zones, including UTC.

Intel introduces first mobile Pentium IIs

Intel Corporation has introduced the first Pentium II processors for mobile PCs. The mobile Pentium II processor, offered at speeds of 233 and 266MHz, is claimed to bring a new level of performance and computing capabilities, not previously available to mobile PC users.

The mobile Pentium II processor delivers the advanced performance capabilities of the P6 microarchitecture while meeting the demanding power consumption and size requirements of mobile PCs. The mobile Pentium II processor is available in an innovative 'mini-cartridge' package, which contains the processor core and closely coupled 512KB Level 2 cache. The mini-cartridge is about one-fourth the weight, one-sixth the size and con-

sumes two-thirds of the power of the Pentium II processor desktop Single Edge Connector (SEC) cartridge, making it well suited for today's broad range of mobile PC form factors, including thin, lightweight, ultraportable systems.

The 233 and 266MHz mobile Pentium II processors are manufactured on Intel's 0.25 micron process technology and offer the same performance-enhancing features as the existing Pentium II processors for the desktop segment, including: Dual Independent Bus architecture, Dynamic Execution and Intel MMX technology. The mobile Pentium II processor system bus operates at 66MHz. Also, to address the unique thermal/energy requirements of mobile PCs, the new processors contains built-in power management features that help to manage power consumption and improve reliability.

The new mobile Pentium II processors operate at an internal core voltage of 1.7V, and are Intel's lowest voltage mobile processors introduced to date.

Swiss tiny-motor specialist Maxon has produced the world's smallest DC brushless motor. Called the 'smoovy', it's just 3mm in diameter — with 1.6mm bearings, each using 17 stainless steel balls 200um in diameter. In fact it's so small it floats on water! More info is available from distributor M. Rutty, (02) 9457 2222.

Aust mining firm to develop Redox battery

Australian mining company Pinnacle Mining NL has secured a technology transfer agreement which will allow it to acquire full ownership and control of the Vanadium Redox Battery technology developed in Australia at the University of NSW, by a team of scientists led by Professor Maria Skyllas-Kazacos. VRB technology has attracted world-wide interest, and the Mitsubishi Petrochemical Company of Japan already operates a 200kW VRB load levelling demonstration plant connected directly to Japan's national grid.

Unlike traditional batteries, the VRB contains no heavy metals such as lead, nickel, zinc or cadmium. The battery stack that provides the power is constructed almost entirely of recyclable plastics.

Dr Malcolm Jacques, MD of Pinnacle, said "The VRB technology is one of the world's most efficient, low cost methods of storing energy and providing motive power, while still offering huge environmental benefits over existing battery types. Obviously we are plased to secure the right to exploit the technology worlwide, while keeping the technology from going offshore."

Pinnacle first became involved after responding to a segment on the ABC's *Four Corners* program, which discussed the difficulty of gaining venture capital in Australia for the battery technology.

Pinnacle has agreed to pay $1.5 million for the technology, which will be paid in three tranches. The Uni of NSW's Unisearch will in return receive an approximate 25% stake in the Company. Pinnacle will assume Unisearch's role as licensor and will receive benefits of all royalties and fees payable under the pre-existing Licensing Agreements.

OTEN electronics course

Among the 200-plus TAFE NSW courses is offers via distance education, the Open Training and Education Network (OTEN) is offering the Electronics Technology (Certificate 1, No. 7780) course. This is aimed at electronics enthusiasts who may not have formal qualifications in electronics, yet have developed their skills through hobby activities. It also caters for those who would like to expand their knowledge, with a view to a career in electronics or telecommunications.

The modules in the Electronics Technology Certificate are nationally recognised by the National Metals and Engineering Training Advisory Board and the National Electrical and Electronics Industry Committee. This course can also be taken as a Board developed course for the HSC, at two unit level.

Students have the continued support of teachers via phone and written comments on assignments. On successful completion of assignments, practical sessions and exams, students are eligible for a TAFE NSW qualification.

For further details and an OTEN Enrolment Pack contact Flynn Henry, Senior Head Teacher Electrical Engineering, OTEN Industry Section. (Phone (02) 9715 8467, fax (02) 9715 8492, or email **oten.courseinfo@tafensw.edu.au**)

Craig Barrett to be Intel's CEO

Intel Corporation has announced that Dr Craig R. Barrett, its current president and COO, is becoming its new chief executive officer. Dr Barrett, 58, succeeds Intel co-founder Andrew S. Grove, 61, who will continue working full time as chairman.

"Craig has been the architect of Intel's operations throughout the last decade. Our performance in developing a superb set of products and meticulously ramping them into high-volume production has been the result of the exceptional organisation and methodology he has put into place", said Grove. "He has also grown into an outstanding multifacetted leader, and is ready to undertake additional challenges as Intel's chief executive officer."

Barrett was born in San Francisco and attended Stanford

IN BRIEF

- Australian frequency control specialist ***Hy-Q International*** has signed reciprocal supply agreements with Horizon Enterprises Electronics Corporation of China, Tai Tien Electric Company Ltd of Taiwan and Kyushu Dentsu Company Ltd of Japan. This will make available a worldwide sourcing capability for all electronic components, as well as offering the lowest possible prices combined with the highest quality standards.
- Malcolm Goldfinch has resigned as Chairman of audio importer and distributor ***Convoy International***, and Mr Alex McInnes has been elected in his stead. Currently Convoy is the Australian distributor for B&W Loudspeakers, Harman Kardon, JBL Loudspeakers, Monster Cable and Lexicon audio products.
- ***NHP Electrical Engineering Products*** has been appointed the sole Australian agent for Krone Terminator Industrial Products. Krone is a world leader in termination products and spends a large percentage of its returns on R&D.
- The Voca division of ***IPL Datron*** has gained the Australian and New Zealand distribution rights for the products of networking

University from 1957 to 1964, where he received his Bachelor of Science, Master of Science and Ph.D. degrees in Materials Science. He joined Intel Corporation in 1974, after working on the Stanford faculty and rising to Associate Professor.

90% of Iridium satellites deployed

A Proton rocket successfully carried seven Iridium satellites into orbit from the Baikonur Cosmodrome in Kazakhstan, in early April, marking Iridium LLC's thirteenth successful launch in eleven months. Two more launches were needed to fully deploy the Iridium constellation, and these were planned for late April.

The seven satellites are part of Iridium LLC's 66-satellite wireless personal telecommunications network, designed to offer full global coverage and a variety of communications services, including voice, data, fax and paging to handheld subscriber equipment. The new satellites joined the 56 that were already in orbit.

"The success of today's Proton launch means that in slightly more than a week's time, 14 Iridium satellites have been sent into orbit on three rocket launches — one from Russia, one from China and one from the United States", said Iridium LLC Vice Chairman and CEO Edward F. Staiano. "This truly international effort is paving the way for Iridium to become the first global wireless telephone company when we begin commercial activation on September 23."

"We have 90% of the Iridium constellation in place and are just weeks away from complete deployment", said Motorola CEO Christopher Galvin. "We congratulate Krunichev Space Center for the important role they have played in lifting 21 Iridium satellites into orbit on three Proton launches, during this intense launch campaign."

Protel goes direct in Europe

Protel International, leading Sydney-based developer of Windows-based electronic design software, has announced that its Worldwide Direct Network has expanded with the recent establishment of Protel Europe in Sisseln, near Zurich, Switzerland. The Worldwide Direct Network delivers Protel's information and products directly to design engineers, ensuring all designers have access to affordable Electronic Design Automation (EDA) software.

Protel Europe will provide direct sales and support throughout Europe. This will ensure that electronics designers in these areas have the same opportunity to benefit from powerful design tools as designers in other regions covered by the Worldwide Direct Network, in particular the United States and Australia.

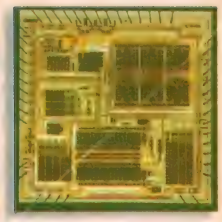
"The philosophy behind Protel's Worldwide Direct Network is a belief that all designers must be able to access the best electronic design tools if the industry is to continue seeing great innovation and advancement", explains Nick Martin, Protel's founder and CEO. "One factor which prevents many designers from obtaining these tools is affordability. Through the establishment of Protel Europe we can ensure that our European customers are always offered affordable products."

Protel has appointed Dr Henry Kunz as Managing Director of Protel Europe. Dr Kunz comes to Protel after more than 25 years involvement in the electronics industry, including more than a decade as a distributor of EDA products in Switzerland. ❖

specialist Intelect Network Technologies. Intellect's products include the S-Lynx multiplexer, the CS4 intelligent programmable switching platform for public and private networks, and the IVC range of multimedia video network conferencing systems.

- The new Keithley 1998 Data Acquisition Catalog and Reference Guide is available from Melbourne-based distributor *Scientific Devices Australia*. Scientific Devices is also able to provide Iotech's 1998 Data Acquisition & Communication Catalog, which features 35 new products. Contact SDA on (03) 9569 1366. ❖

Solid State Update



Keeping you informed on the latest developments in semiconductor technology

Analog switches in TSSOP-16 package

Siliconix has cut the size of its most popular analog switches by more than half with the introduction of a new TSSOP-16 package option, claimed as an industry first for this device type. The new TSSOP-16 devices have a footprint of 6.4 x 5.0mm, with a height profile of just 1.1mm. As a result they'll save space in cell phones, portable data acquisition instruments, portable automatic test equipment, and battery-powered systems.

Released in the TSSOP-16 package are the DG201 BDQ, DG201 HSDQ, DG202BDQ, DG211BDQ, DG212BDQ, DG213DQ, DG308BDQ, and DG309BDQ. These general-purpose quad analog switches are built on a proprietary high-voltage silicon-gate process and offer enhanced performance over the industry-standard versions offered by several suppliers, allowing designers to easily upgrade their systems at virtually no additional cost.

In addition to their small packaging, the TSSOP-16 devices combine low on-resistance, leakage currents and charge injection with fast turn-on times. The new DG201BDQ and DG202BDQ, for example, offer on-resistance of 45Ω, with a 120ns turn-on time and 1pC charge injection. The high-speed DG201 HSDQ offers even more advanced specifications: on-resistance of just 25Ω and turn-on-times of just 38ns.

For more information circle **271** on the reader service card or contact Siliconix distributors Braemac or Avnet VSI Electronics.

Dual low power 350MHz op-amp

The Analog Devices AD8012 dual-amplifier IC offers wide bandwidth, low distortion and high output current drive, all with low power consumption. The AD8012 is designed for use in any application requiring high performance with minimal power consumption. These applications include digital subscriber line (VDSL, HDSL) drivers, buffer amplifiers, CCD imaging systems, digital cameras, ultrasound equipment and similar systems.

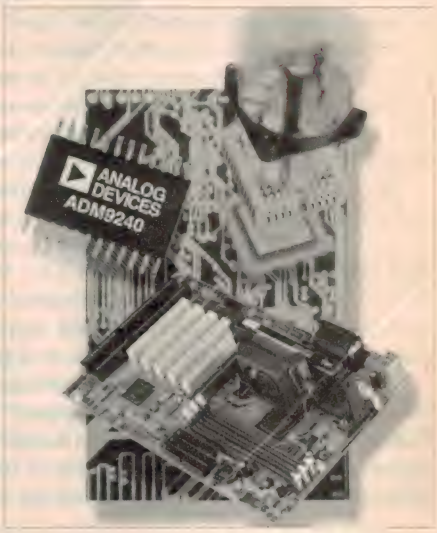
High bandwidth operation is assured by the AD8012 dual amp's 3dB bandwidth of 350MHz, and it does so at a maximum of 1.9mA of supply current per amplifier. At 500kHz into a 100Ω load, the AD8012 amplifier's highest harmonic is a very low -72dBc. Also at 500kHz into a 100Ω load, the intermodulation distortion (IMD) is an exceptional -77dBc.

The AD8012 can typically provide 125mA output current while maintaining good video distortion performance. It is well suited for video system designs, too, with its 0.02% differential gain error, and 0.06° differential phase error (1kΩ load) specifications.

For more information circle **272** on the reader service card or contact Analog Devices, PO Box 2098, Rosebud Plaza 3939.

DMI 2.0-compliant motherboard monitor

The Analog Devices ADM9240 is a complete system hardware monitor for microprocessor-based systems that provides measurement and limit comparison of a total of six power supplies, two programmable for processor core voltages, plus temperature, fan speed and chassis intrusion. It is the industry's leading Heceta II ASIC implementation for Intel's



Wired for Management (WfM) initiative.

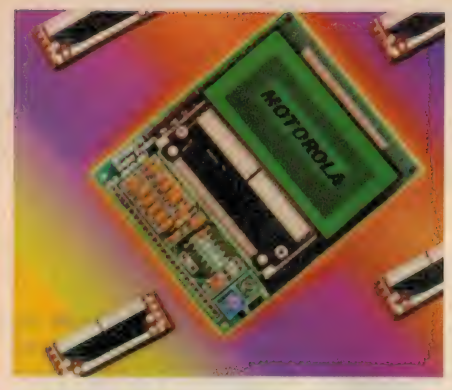
The DMI 2.0-compliant, single-chip monitoring device includes on-chip temperature sensing, supply voltage attenuation network (eliminating resistors) and fan speed monitoring circuitry, plus analog/digital conversion facilitates communication over the SMBus. In addition, the on-chip DAC is used to control fan speed for present and next generation ACPI-compliant systems. The ADM9240 was recently recommended by Intel for use in motherboards that feature the Pentium II processor.

The ADM9240 features a programmable comparator with hot trigger point and hysteresis, and one-time interrupt and comparator modes. Also featured are two programmable fan speed monitoring channels with nominal speeds of 8800, 4400, 2200 and 1100 RPM, six programmable channels with on-chip resistive attentuators for direct voltage input +12V, +5V, +3.3V and +2.5V, plus two processor core voltages for microprocessors, such as those found on the Intel Pentium II, from 0 to 3.6V with 14mV resolution.

For more information circle **273** on the reader service card or contact Analog Devices, PO Box 2098, Rosebud Plaza 3939.

Ultra low power LCD driver chip

Motorola has introduced a new ultra-low-power LCD driver chip with many on-board functions, which consumes only 1uA in the standby mode. It's claimed to dramatically



improve battery life for high performance mobile communication system designs.

The new MC141590 is designed to drive up to 160 x 65 full dot matrix monochrome STN liquid crystal displays (LCD). The unit will also sharply reduce the parts count in applications since it integrates all common, segment driver outputs, voltage generator, voltage divider. timing generator, temperature compensation circuitry, contrast control and graphic display data RAM on a single chip.

An 8-bit parallel interface is used for direct communication with general microcontroller units. The part also offers such features as enhanced low-power icon mode, which provides 160 icons displayed at less than 25uA current consumption, and display masks for a blinking effect, which enhances device performance.

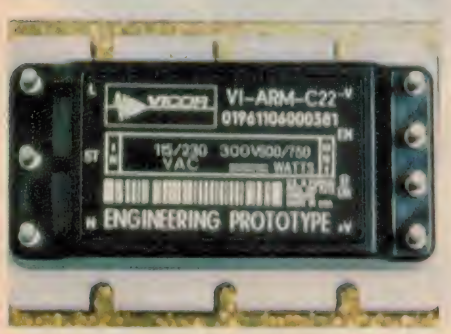
For more information circle **274** on the reader service card or contact Motorola Semiconductor Sales, 673 Boronia Road, Wantirna 3152.

Autoranging rectifier module

Vicor's latest addition to the VI-ARM range of autoranging rectifier modules provides 500 or 1000 watts of power rating in the same tiny 36.8 x 57.9 x 12.7mm package.

Vicor's VI-ARM modules house the entire front end of a switching power supply in a compact package. The user merely adds a filter and a holdup capacitor appropriate to the application. The modules include a controller that continuously tracks the AC line to ensure correct strapping of the doubler.

Combined with Vicor DC/DC converters, VI-ARM modules provide a high power density, low profile, off-line switching power solution for systems that require a rugged, full featured interface to the AC mains in the smallest package.



Microprocessor controlled, the ARM family has an efficiency of 96-98% and is UL, CSA, TUV, VDE, IEC950, CE and BABT approved.

For more information circle **277** on the reader service card or contact Powerbox Australia, 4 Beaumont Road, Mt Kuring-Gai 2080.

Fast voltage limiting amps for video & comms

Burr-Brown's new SpeedPLUS OPA688 and OPA689 are wideband, voltage limiting amplifiers (VLA) for op-amp applications where the output should be strictly limited, overdrive recovery time is a concern, or where non-linear analog signal processing is needed. OPA688 is unity gain stable (G >+1) while OPA689 is high gain stable (G >+4).

Innovative output limiting architecture holds the limiter offset error to +15mV, giving linear operation to within 30mV of the limits, and recovers very quickly from output overdrive. Two buffered limiting voltages take control of the output voltage when it tries to go beyond these limits. The combination of narrow nonlinear range and low limiting offset allows the limiting voltages to be set within 100mV of the desired linear output range. In addition, a phenomenal 2.4ns recovery from limiting ensures that the overdrive signals will be transparent to the signal channel.

OPA688 features 530MHz bandwidth (G = +1), 1000V/us slew rate, and +/-15mV limiting voltage accuracy. OPA689 features 280MHz bandwidth (G = +6), 1600V/us slew rate, and +/-20mV limiting voltage accuracy.

For more information circle **275** on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130.

12-bit quad DACs

Burr-Brown's new DAC7624 and DAC7625 are 12-bit, quad voltage output digital-to-analog converters (DACs) based upon a 2um BiCMOS process technology which produces smaller integrated circuits (ICs) consuming less power. Using this technology, the DACs provide the small footprint and low power consumption (10mW) needed in a wide variety of applications such as process control, automated test equipment (ATE), motor control, data acquisition systems, and DAC-per-pin programmers.

The DAC7624 and DAC7625 feature voltage output specifically designed for single-supply and low voltage dual-supply applications — single +5V supply or +/-5V supplies. Both accept 12-bit parallel input data, have double-buffered DAC input data logic (allowing simultaneous update of all DACs), and provide a data readback mode of internal registers. In addition, the DACs offer an asynchronous reset which clears all registers to midscale on the DAC7624 or zero-scale on the DAC7625.

Key specifications include low power consumption (10mW), 12-bit monotonic performance over full temperature range (-40° to +85°C), fast settling time (10us to 0.012%), and unipolar or bipolar operation.

For more information circle **276** on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130.

16Mb low voltage Flash devices

AMD has introduced two additional 16Mbit, high-density flash devices for its zero-power flash family — the Am29LV116B and the Am29LVO17B, now shipping. Both devices, along with the previously announced Am29LV160B, offer a broad choice of configurations to address high density flash requirements.

These devices are targeted at applications that require extremely high reliability, such as networking, telecom and flash memory cards. The Am29LV116B, a x8 boot sector device, is targeted at high-density embedded applications such as telecom and networking. The Am29LVO17B, with uniform sectors, is intended for mass storage applications such as PCMCIA memory cards and miniature cards.

Standard features include zero-power operation, advanced 0.35-micron flash technology; single-supply operation for read and write; extended 2.7 - 3.6V operating range; high performance (as fast as 90ns at full voltage range and 80ns at regulated voltage range); Common Flash Memory Interface (CFI); and JEDEC/industry standard architecture.

For more information circle **278** on the reader service card or contact AMD Australia, Level 14, 33 Berry Street, North Sydney 2060. ❖

New Products

Desk mount maglamp

Jaycar Electronics has released a high quality, all metal frame magnifier featuring a built-in 22W circular fluoro lamp. The magnifier itself is a three-dioptre lens, with a metal handle mounted on the magnifier head for quick re-positioning. The head is mounted on a flexible extension arm assembly that boasts a total extended length of 990mm.

The magnifier base screws to the side of any desk or workbench (approximate allowable tabletop thickness is 45mm), and the magnifier arm then slots into the base. The fluoro lamp can be turned on or off by a head-mounted switch, and is provided with a generous 2m mains cord and plug.

The magnifier is a great tool to assist PCB assembly/inspection, jewellers, stamp/coin traders, etc. Replacement tubes are readily available from most lighting stores. The QM-3525 desk mount lamp is available through all Jaycar outlets for $149.50.

For more information circle **241** on the reader service card or contact Jaycar on (02) 9743 5222 for details of a store or dealer closest to you.

Big, bright & smart displays

Veeder-Root brand AWESOME Intelligent Displays are claimed as the industry's biggest, brightest 1/8 DIN displays. Increased size and brightness make the displays easy to read from a distance, and programmability makes them a valuable process tool.

AWESOME Intelligent Displays are 25% larger, with easy-to-read 18mm digits. They can be programmed to change colour from red to green, or green to red, at a preset value — in addition to alarm and control functions. The modular design of the displays allows the user to plug in additional functions, such as an RS-485 interface. And the short 100mm depth offers financial savings by permitting the use of narrower 125mm control panels.

The displays are CE approved, and easy to use. All parameters are programmable from the front panel, and a secondary display provides a single character legend to identify the main display value. The 'HELP' function provides a full alphanumeric description of the parameter for three seconds before the value is displayed.

For more information circle **242** on the reader service card or contact Micromax, 307 Keira Street, Wollongong 2500.

Hakko 936 solder station from Jaycar

Jaycar Electronics has announced its release of the well renowned Hakko brand 936 soldering station. The 936 features a thin grip soldering pencil, compatibility with the 900-series of tips and a lock screw to prevent inadvertent changes in the temperature setting.

The station features a modular case so that two stations can be stacked on top of one another for maximise bench-space efficiency. The heating element is rated at 50W, to deliver a temperature range of 200 to 480°C with a stability of +/-0.5°.

The TS-1610 station retails for $199.00 and is available through all Jaycar Electronics outlets. It's a superb station for industry professionals and serious electronics hobbyists/enthusiasts alike.

For more information circle **243** on the reader service card or contact Jaycar Electronics on (02) 9743 5222, for details of a store or dealer closest to you.

Compact AC/DC converters

Due to its extremely compact design and low profile of only 18mm, Melcher's SWE O5 converters are particularly suitable for space-sensitive applications. They also offer a universal input voltage range of 85 - 264V AC. The converter's compactness was achieved through a novel transformer design.

LED output status indication and a potentiometer for fine output voltage tuning within +10% are additional standard features. A comprehensive protection scheme against inrush current and overload ensures a long service life and high power reliability.

The SWE 05 is particularly suited to light industrial applications such as instrumentation, process controls, displays, alarm systems, computer peripherals and weighing machines. There is a choice of open frame or covered units with either screw terminals or JST type connectors.

For more information circle **244** on the reader service card or contact Scientific

Devices Australia, 118 Atkinson Street, Oakleigh 3166.

Handheld TDR for digital phone cables

The Tektronix TelScout TS90 time domain reflectometer (TDR) is a handheld instrument that provides low-cost, high-performance testing for telecommunications cabling systems. Network operators can use the instrument to efficiently install and

maintain their twisted-pair plant or to deploy new digital services including ISDN and ADSL. Using the TS90, outside plant technicians can quickly identify and locate faults in twisted-pair cable.

Designed for telephone local-loop applications, the rugged TS90 applies the newest measurement technology to provide both ease of use and telephony testing performance not found in other TDRs. For example users need only choose the cable type to be tested and the instrument automatically selects and adjusts the impedance, Vp, gain, pulse width and vertical position while the user scans the cable.

The TS90 also provides advanced filtering and signal processing technology that ensures maximum measurement range (up to 45,000 feet) and clean waveforms for easy fault interpretation. Providing accuracy of up to 3ft at 10,000ft, it can be configured for any cable type and Vp (0.300 to 1.000).

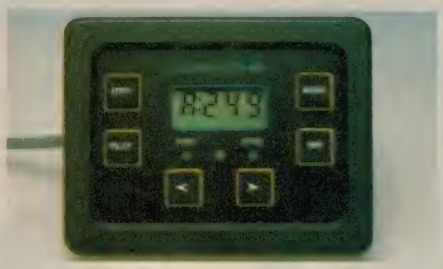
For more information circle **247** on the reader information card or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113.

New Australian made autopilot

Designed and built in Australia for power and sailboats up to 14m (45') long, the new Coursemaster CM420 autopilot is very simple to operate. With a touch of a key it will steer your boat effortlessly, interfacing with GPS and chart plotters, leaving you free to enjoy your time on the water.

The LCD screen on the CM420 is very easy to read, a big plus for an autopilot in the lower price range. The CM420 is available from Coursemaster Autopilot's Australia-wide dealer network from an RRP of $2092.

The CM420 can be fitted simply to most



existing steering systems, and includes an extensive range of drive options: linear, hydraulic, rotary, solenoid and mechanical. It uses advanced microprocessor technology and can interface fully with GPS navigators, chart plotters and wind instruments.

For more information circle **248** on the reader service card or contact Coursemaster Autopilots, 7 Smith Street, Chatswood 2067. ❖

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DMMs from CIE offer value, quality

Well known and respected Sydney T&M distributor Obiat has recently added to its range of high quality, but competitively priced handheld digital multimeters, thermometers and accessories from Taiwan manufacturer CIE. Here we look at some of the new and interesting models available.

by Jim Rowe

In larger firms and organisations, it's been traditional to buy only premium-brand multimeters, to ensure accuracy and long-term reliability. Which is fine, of course, if you can justify paying the extra cost. It's just that not everyone can, especially private individuals or smaller organisations and when you're considering an instrument only for making day-to-day measurements...

Respected Sydney-based test & measurement distributor Obiat has of course been handling the highly respected Fluke range of instruments for many years, and with great success. But a couple of years ago they began to offer a second range of handheld DMMs and accessories, presumably to complement the Fluke products and offer alternatives for those who couldn't justify the additional cost. The second range comes from Taiwan manufacturer Chung Instrument Electronics Industrial (CIE), which actually makes quite a few other familiar brands on an OEM basis (no names, no pack drill).

I don't think Obiat is handling the entire CIE range of handheld DMMs and thermometers (there are over 30 in all). However they do seem to have selected a very strong subset, plus a high proportion of CIE's matching current clamps, test probes and other accessories.

Recently we had the opportunity to check out some of the newer products in the CIE range, and we were most impressed. They seemed to be well designed, solidly made and well endowed with measurement features and facilities — so when their competitive pricing is taken into account, they appear to represent very good value for money.

One instrument that immediately caught our eye was the **125TRMS**, a compact but sturdy 3-1/2 digit 3200-count 1.2% basic (DCV) accuracy unit which offers all of the usual basic DMM ranges plus the added assurance of true-RMS readings for current and AC voltage measurements. A true-RMS reading DMM is almost mandatory nowadays if you're not to be led astray when taking measurements of complex-waveform voltages and currents, and at the quoted price of $149 the 125TRMS brings ownership of such an instrument within most people's grasp.

It also offers a clear 34-segment 'analog bar graph' display underneath the main 12mm-high digital display, and features like autoranging (with manual range over-ride), reading hold, a 10A current range and auto power-off after 10 minutes of inactivity.

By the way for those who either don't need, or can't afford the true-RMS reading feature, Obiat also stocks the model **125**, with most of the other features, and the **125C**, with capacitance ranges in place of the current ranges. These versions each sell for only $98.

On the other hand for those who *do* need the true-RMS, but also need a little more resolution and accuracy, there's the model **8050** — a 4-1/2 digit 19999-count 0.05% basic accuracy unit which also adds current measurements to 20A, three frequency ranges (2, 20 and 200kHz) and ranges for duty cycle (0 - 90%) and logic level. Manual ranging, the 8050 is priced at $189.

Another impressive new instrument is the model **2606**, a very solidly made digital clamp meter which virtually combines a full function autoranging 3-3/4 digit 3999-count 0.5% basic accuracy DMM with an AC/DC clamp ammeter measuring to 1000A — with true-RMS measurement facilities thrown in, on both AC volts and AC current ranges. For good measure it also measures capacitance (to 40uF) and frequency (to 400kHz), as well as providing data hold, max/min record, peak hold and relative zero functions. Readout is via a very clear LCD with digits 17mm high, plus a 42-segment analog bar graph.

The model 2606 is priced at $298, but if you don't want or need the true-RMS AC current capability and can live without the DC current and capacitance ranges, there's the similar **2604** clamp meter selling for only $198. This provides traditional average-sensing rectification for the AC voltage and current ranges.

There's also the model **2608**, which provides another variation on the same clamp meter architecture: average-sensing AC measurements, but both AC and DC measurements to 2000A plus capacitance ranges again. This model sells for $398.

AC-DC clamp adaptor

For those of us who don't need to measure hundreds of amps, but *would* like to have the ability to measure somewhat smaller currents with good resolution, there's another interesting new CIE product: the model **CA-60** Clamp Adaptor. This is a self-contained unit designed to add both AC and DC current clamp measurements to virtually any DMM with nominal 200mV and/or 2V ranges, and with an input resistance of at least 1MΩ. Operating from an internal 9V alkaline battery, it effectively acts as a current-to-voltage converter, with selectable conversion factors of either 1mV/10mA or 1mV/100mA and a nominal current capability to 60A.

Based on Hall-effect sensors, the CA-60 has a basic DC accuracy of 1.5% and on AC can be used to make readings at frequencies between 40Hz and 20kHz, with accuracy within about 8%. It also has an 'auto zero' button to compensate for hysteresis effects when you're measuring DC currents. The jaws can open to accommodate a conductor 9mm in diameter, and the overload capability is 80A for up to 60 seconds.

In short, the CA-60 current clamp adaptor is potentially a very useful device. It is priced at $169.

Moving to CIE's not quite so new products, there are two very nice dedicated digital thermometers — the model **305**, with a single thermocouple input, and the **307** which has two thermocouple inputs. Both are designed to operate with type-K thermocouples, and in fact come with either one or two bead-type thermocouples as appropriate. They both provide a selectable reading resolution of 1°/0.1°, can read in either Celsius or Fahrenheit, and cover the range from -50°C to 1300°C (-58°F to 2000°F).

A selection of the CIE meters and accessories now available. At front left is the 125TRMS DMM, with the 8088 Automotive Meter and its HA100 inductive pickup visible at upper right.

Other handy features of the 305/307 include front panel offset adjustment(s), a maximum reading record function, reading hold — and on the 307, the ability to make differential measurements. The 305 is priced at $119, while the 307 is priced at $159. A variety of K-type thermocouple accessory probes is also available.

Automotive meters

Then there are CIE's Automotive Meters — the **8088** and the **128**. On the surface these both look a bit like a standard DMM, but in reality they offer a surprising number of additional functions and features, dedicated to efficient troubleshooting in modern cars. This is especially so with the model 8088, which measures engine RPM via an inductive probe (supplied); frequency, for checking MAP, MAF and other sensors; duty cycle and dwell angle, for EFI, feedback carburettors and ignition; positive or negative pulse width, for fuel injectors, idle air control valves and electronic transmission controls; and temperature (°C/°F), for checking fans and thermostats, and monitoring air and manifold temperatures.

Needless to say it also provides all of the standard DMM ranges — including current to 20A, capacitance and resistance ranges, and diode/continuity test. Plus autoranging, relative zero set, data hold, maximum/minimum capture, auto shutoff and so on. It's pretty well everything you'd need for basic automotive troubleshooting, and seems good value for money at $329 considering it comes complete with an HA100 heavy-duty inductive pickup clamp, a K-type thermocouple probe and a set of test leads and probes, plus user manual.

The smaller model 128 has a less comprehensive repertoire, lacking the ability to measure capacitance and pulse width, and losing a few features like triggering polarity selection, min/max capture and relative zero set. It also measures current to only 10A. However it still comes with the HA100 inductive pickup, K-type thermocouple probe and test lead set, and therefore seems very good value at $229.

Before closing, there's one of the CIE accessories that caught my eye: the HVP-40 high voltage probe, which has a division ratio of 1000:1 and allows a standard DMM to measure safely up to 40kV DC or 28kV AC, with an accuracy of around 1%. This is priced at $149, which is significantly cheaper than similar HV probes available elsewhere — have you checked the prices lately?

Incidentally I should note that all of the prices quote above are *excluding* sales tax, which would need to be added if applicable.

Finally, it's worth noting that just about all of the CIE handheld DMMs, thermometers and automotive meters come complete with protective rubber holster, a set of high quality safety test leads, carrying strap and user manual. So they're well worth serious consideration, if you're after good quality at a less than premium price. ❖

CIE handheld DMMs

A good-quality, competitively priced range of handheld instruments and accessories made in Taiwan.

***Good points**: Solidly made, offer good value for money in terms of functions, features and accessories.*

***Bad points**: Some user manuals are a little cryptic.*

***Available**: Obiat, 129 Queen Street, Beaconsfield 2014. Phone (02) 9698 4111, fax (02) 9699 9170.*

New Test & Measuring Products

Optical converters for Tek's DSOs

Tektronix has released a new line of optical-to-electrical (O/E) converters for use in conjunction with its sampling oscilloscopes. The converters provide added functionality to Tektronix CSA803C and 11801C communications signal analyzers for SONET/SDH 2.488 Gb/s transmission signals. Combined with the TDS 500C/700C digital storage oscilloscopes announced last year, the converters provide designers with a complete suite of physical-layer test instruments. The suite allows accurate characterising, debugging and verifying for standard compliance of SONET/SDH OCI/STMO through 0C48/STM16 optical communication signals.

The complete package of internal communication templates/masks and automatic measurements within the 11800C/CSA803C oscilloscopes, coupled with the new set of O/E converters, enables users to analyze S0NET/SDH 2.488Gb/s optical transmission systems.

The new SD-44 15GHz O/E converter is optimized for characterising the pulse shape of optical signals up to 2.488Gb/s, where frequency components of five times the data rate (>12.5GHz) are required to be analyzed. The conversion gain of 35mV/mW and noise floor of 15pW/√Hz provide enhanced performance over existing high-bandwidth O/E converters.

The ORR24 is an amplified 2.0GHz O/E converter with a built-in 4th-order Bessel-Thompson frequency response, as required by the ITU-T G.957 standard for a compliant SONET/SDH 2.488Gb/s reference receiver. The low noise, low aberration and DC-coupled design of the ORR24 ensure accurate and repeatable extinction-ratio measurements. The ORR24 is calibrated at 1310nm and 1550nm wavelengths, and includes a frequency-response graph that certifies a controlled frequency response out to twice the data rate (5GHz).

For more information circle **201** on the reader service card or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113.

Memory recorder has full-colour TFT display

The new Hioki Model 8835 HiCorder is a highly economical memory recorder with four channels of analog and 16 channels of logic signal recording capacity. The high native memory capacity of 100K words per analog channel (500K words if using only one analog channel), when combined with the instrument's memory expanding options to 2MB, provide for long term recording without compromising time resolution.

Standard on-board data storage facilities include a PCMCIA-card slot and floppy disk drive, with a hard disk card (memory capacity to 528MB) being available as an option.

The high resolution A/D converter has a vertical resolution of 12 bits and a sampling rate of 1MS/s, providing excellent time resolution to 1us time difference data points. This resolving power when combined with a very high level of triggering capability, is claimed to make the Hioki 8835 ideally suited for problem solving in high-speed control electronics, and capturing glitches with pre- and post-event recording from the triggering point.

Visual data output is provided via a full colour, high clarity TFT screen, enabling ready channel identification through colour coding; and also through high-resolution thermal printing on 110mm width paper.

For more information circle **202** on the reader service card or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066.

Parametric test system runs on Windows NT

Keithley Instruments' new Model S900NT PC-Based Parametric Test System is designed for cost-effective process monitoring and device characterisation in semiconductor testing environments, running under Windows NT.

Keithley's Model S900NT is claimed as the first parametric test system in the industry designed to operate under Windows NT, providing users with high measurement stability and robust capabilities in a Windows environment.

The S900NT system links high speed instruments, a low-noise switching matrix and PC with the versatile Keithley Test Environment (KTE) software, to form a powerful parametric test system. The result is said to be a comprehensive, cost effective combination for both MOS and bipolar process monitoring or device development testing.

The design of the system includes high accuracy instruments such as one or more source-measure units and the Model 9631 Integrating System Voltmeter Unit (ISVU). The source-measure units can be programmed to apply voltages up to 100V and currents up to 1.5A. The ISVU digitises the source-measure unit output for processing by the KTE software. The ISVU's line cycle integration feature reduces noise-related errors.

Accuracy is further enhanced by optional capacitance and current measurement instruments with resolution to 0.3fF and 0.6fA.

For more information circle **205** on the reader service card or contact Scientific Devices Australia, 118 Atkinson Street, Oakleigh 3166.

Precision power source for testing

The Keithley Instruments Model 2303 High Speed Precision Power Supply is optimised for automated testing of portable, telecommunication devices such as cellular phones, cordless phones, pagers and mobile radios. It provides precision power control, load sinking, and current monitoring in IEEE-based test systems under computerised supervisory control.

The 2303 is a high-speed, readback power supply optimised for the newer and smaller telecommunication devices, providing an economical test solution by matching power output to the requirements of these devices. Other features available for the first time in a precision power source of this type are digital outputs for test system control and a unique long-integration mode for averaging device performance over a wide range of operating conditions.

Like other Keithley products in this line, the Model 2303 has a fast transient response and high-speed current measurement capability for devices that undergo large load (or pulse) changes over very short time intervals. It is rated for 45W service and can deliver as much as 5A at 9V DC to satisfy the peak pulse loading requirements of many portable telecommunication devices.

Alternatively it can supply up to 3A at 15V DC. It can also be used as an electronic load and sink current up to 2A at 7V DC, simulating a discharged rechargeable battery to verify performance of a portable device's charger.

For more information circle **207** on the reader service card or contact Scientific Devices Australia, 118 Atkinson Street, Oakleigh 3166.

HP combines logic analysis & emulation

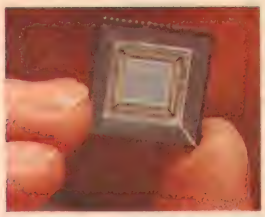
Hewlett-Packard has released two new digital-system-debug tools which combine logic analysis and emulation to provide system designers with more control of and visibility into system behavior than is possible with a logic analyzer or emulator alone. Design team members can use the same tool to identify the exact nature of hardware-software interdependencies, including such hardware-dependent software problems as part variability, response times, timing and signal fidelity, or software-dependent hardware problems such as the sequence of events, responses to interrupts and real-time anomalies.

The two digital-system-debug tools provide customers with a choice of performance and price — one is modular, the other preconfigured. Both systems provide a graphical, windowed interface. They accommodate most of the latest measurement modules designed for the HP 16500C logic analysis system and support emulation solutions for the following microprocessor families: MPC 500 and 800, PowerPC 600 and 700, Pentium, Pentium Pro, CPU-32, ARM, M.CORE, NEC V83X, Hitachi SH3 and Hitachi SH4. Analysis probes are available for another 150 microprocessors, microcontrollers and buses.

The HP 16700A is a modular, high-performance platform for designers using leading-edge microprocessors in multiprocessor systems, core-based application-specific integrated circuits (ASICs) or systems on silicon (SOS). It provides breadth of measurement capabilities and headroom for future measurement needs.

The HP 16600 series is a preconfigured system with built-in analysis capabilities. A new feature is context-store capabilities that allow a designer to record events leading up to a trigger condition on each occurrence of the trigger condition.

For more information circle **208** on the reader service card or call HP's T&M Call Centre on 1800 629 485. ❖



Silicon Valley Newsletter

Natsemi launches chip for sub-US$500 PCs

INTEL MAY BE struggling to enter the microprocessor market for sub-US$1000 computers, but National Semiconductor has unveiled a new chip that will help create a market for sub $500 computers by mid-1999.

National said it new Cyrix-based processor integrates both the CPU and 12 additional vital PC ICs onto a single chip, thus vastly reducing system design and production costs. The processor, which will contain 30-40 million transistors, will be built on a new 0.25 micron wafer fab under construction in the state of Maine. The plant will have a capacity of 30,000 eight-inch wafers per month. Taiwan Semiconductor Manufacturing (TSMC) and IBM will provide additional production capacity for the chip.

"Everything we have been doing is putting all the pieces together", said National Semiconductor CEO Brian Halla, adding that he expects the chip will cause PC prices to fall to US$400 - $500. "The pricing is up to the PC suppliers, but what we are trying to do is... put more functionality on the chip by putting more and more intelligence on the chip."

The first working version of its chip will be available by year-end and it could be in volume production by June 1999.

223M transistors on a chip, says LSI

LSI LOGIC has announced a new so-called G12 chip technology that will let its customers to build single-chip-based cellular telephones, fax machines, cameras, computers and other consumer electronics products. The G12 chips allows for chip elements with features as small as 0.13 micron, two generations ahead of the 0.25um technology that is just now coming into production at leading DRAM and microprocessor manufacturers.

G12 chips will be able to hold up to 223 million transistors on a single chip, including mixed signal, logic, embedded memory and radio frequency components. Each chip offers designers 65,000 usable gates per square mm and features 26 million usable logic gates on a tiny 20 by 20mm silicon chip. That's more system-on-a-chip capability than has ever been available on this size chip.

The first G12 chips are expected to hit the market in sample quantities in the fall of this year, with production starting around May of 1999. LSI Logic chairman Wilf Corrigan said the G12 technology will enable system houses to design products that are not even imaginable yet, such as a consumer electronics device that combines three to four functions in one system, such as a set-top box, a DVD player and a VCR.

Microsoft, Intel to integrate TV & PCs

LAST YEAR, Intel, Microsoft and Compaq were all but thrown out of the annual convention of American television broadcasters in Las Vegas after demanding that the television industry adopt personal computer standards for integrating television and computer technologies. This year they returned to the show with new proposals, they hope will entice broadcasters to add more and more computing features to their programming.

Microsoft and Intel announced they had agreed on a new standard for allowing television broadcast networks and other producers to create interactive content such as advertising and sales offers for computer users. Under the agreement Intel's Intercast software will be integrated into Windows 98. The technology enables computer users to view TV programming on their PC as well as related information sent by broadcasters across TV airwaves — such as programming guides that look like Web sites. For example, a viewer might be able to see news about a tennis player during a televised match. Intercast also lets users manipulate the TV picture so it takes up the entire computer screen or just a small corner.

Microsoft also said it plans to include 'WavePhore' software in Windows 98, which will enable PC users to receive Internet pages and TV programming through an unused part of the TV broadcast spectrum.

PC users have been slow to add TV viewing capability to their machines, in part because the feature has not been seamlessly integrated with the operating system. With the launch of Windows 98, Microsoft is rumoured to be planning a major push to get PC manufacturers to include TV tuner cards as standard equipment in their machines.

Sony & Microsoft to network the home

MEANWHILE, Sony and Microsoft said they are teaming up on the development of a single standard to connect personal computers, home entertainment systems, digital cameras, televisions, VCRs and various appliances into a single network for the home. "The time has come for the personal

Canon USA Inc. and 8X8 Inc. have announced a joint project to promote videophones and communications cameras for remote monitoring, surveillance and business applications. The new camera and comms unit shown are said to be very economical and easy to use.

computer industry and the audio-visual industry to shake hands. The cooperation between Microsoft and Sony will play a key role in making this happen," said Sony President Nobuyuki Idei.

No specific details were revealed for the so-called Home Networking Module standard, which will allow a wide variety of applications to run with various operating systems, such as Windows, Sony's own proprietary systems or systems from other vendors. Idei and Microsoft's Craig Mundie, senior VP of the firm's consumer platform division, said the agreement entails broad technology cross licensing arrangements that will enable engineers from the two companies to share knowledge in the development of the home networking standard.

Among other things, Sony will license Microsoft's Windows CE operating system, while Microsoft will license Sony's home networking module that is based on a new standard for wiring electronics. "The digital in-home network will allow many devices and services to interoperate. It's going to make the consumer's life much simpler", said Howard Stringer, president of Sony's US subsidiary.

The move is a logical extension of other areas in which Microsoft and Sony have already been cooperating or have similar interests. Microsoft has been working closely with Sony on Microsoft's WebTV product. Microsoft also is working on set-top boxes for cable, broadcast and satellite television. "We think all of these things have the potential to provide a low-cost migration path for the consumer, from the world they know of analog or digitally delivered analog television today, into this world of intelligent appliances and in particular intelligent digital television", said Microsoft's Mundie.

Xerox laying off 9000

XEROX HAS ANNOUNCED it is planning to reduce its workforce by some 9000 people. The company, which employs 91,400 people worldwide, said it needs to make the cuts in order to better compete with Hewlett-Packard and other companies in the highly competitive markets for lower-priced digital copiers and printers.

"Those companies have much lower costs than ours, and we think to compete effectively, we need to get our costs down into the range of those competitors", said Xerox spokesman Judd Everhart. Xerox will take a one-time charge of US$1 billion to cover the cost of the layoffs and operations restructuring. Xerox said its operating costs will be reduced by about US$1 billion annually within three to four years.

In 1997, Xerox unveiled a family of digital copiers that tie into computer networks. The company said it plans to aggressively market the new products in office super stores in a direct challenge to Hewlett-Packard's dominance. Rather than wielding a blunt axe, Xerox said the workforce reduction will be made through a combination of attrition, early retirement and layoffs.

About 45% of the jobs will be cut from the United States, another 45% from Europe, and the rest from Latin America and Canada.

Allan pays US$2.8 billion for cable firm

MICROSOFT CO-FOUNDER Paul Allen has entered the cable television market by paying US$2.8 billion for Marcus Cable Company of Dallas, Texas. Marcus is America's largest privately held cable TV company, with 1.2 million subscribers.

The Marcus Cable deal is Allen's largest personal investment in his 'Wired World' portfolio of multimedia businesses. He also owns two professional basketball and football sports franchises, worth a combined $500 million.

Allen said he hopes Marcus Cable will be a vehicle for acquiring other cable companies across the United States and to develop new digital services such as Internet access and real-time video rentals for television subscribers. "We plan to continue to invest in this market, looking both for ways to grow existing market business and for opportunities to bring exciting technologies into the cable area", he said. "By becoming a partner in Marcus Cable, I will finally have some wires for my Wired World."

Jeff Marcus, founder of Marcus Cable, said he has agreed to remain as general partner and chairman. "Paul told me he would like to see significant expansion of the company and we will be working closely together to achieve that goal."

Sun & IBM announce new NC alliance

IBM AND SUN MICROSYSTEMS have announced a major new effort to develop the market for corporate network computers (NCs). The machines will be based on new system specifications and a Sun-based Java operating system to be jointly developed by the two companies.

The first of the Sun-IBM-based NCs will be able to hit the market some time in 1999 and will sport the new 'JavaOS for Business' operating system. The machines will be targeted at corporate customers. IBM will run the new JavaOS on its NCs and Sun will shift its NC customer base over to the new platform in the second half of next year. Sun and IBM also plan to license the operating system to other network computer makers in the hope it will become an industry standard.

While Java remains a Sun property, JavaOS for Business will be "a co-developed, co-marketed product that will be the same whether it has an IBM label or a Sun label", said Art Olbert, VP of business development for IBM's Network Computer Software Division. ❖

Jobs woos broadcasters at NAB convention

In his keynote address at the National Association of Broadcasters convention in Las Vegas, Apple Computer co-founder and acting CEO Steve Jobs asked the TV broadcasters to join Apple in jointly exploring new opportunities as the broadcasting industry changes from analog to digital transmission.

"We're dying to work with you", Jobs said. "The computer community knows nothing about entertainment. However, much of the entertainment community is not particularly technically literate either. Now you guys are some of the most technically literate part of the entertainment community."

Jobs said the problem the broadcasting industry is facing as it enters into the digital age is that is a lack of technology standards. "The problem right now is a very simple one, which is that we got ourselves a zillion standards. What we've basically got is a tower of Babel."

The lack of standards make it difficult for content developers to create material that can easily be used in a variety of media, such as television, video conferencing, the Internet, PCs, corporate intranets, etc.

Jobs said that while Apple may not be the leader in the computer market, it remains the undisputed leading innovator of multimedia software technology that lets artists mix sound, pictures and words on computers to make anything from TV commercials, Internet pages, movie films and special effects for TV shows and films.

Netscape puts Navigator source on the Web

Source codes are traditionally the crown jewels of any software company, and Netscape's move in posting the source code for its Navigator browser on the Web is unprecedented among large software companies. But the Mountain View company said the move will play a key role in stemming the stampede in the market towards Internet Explorer, the competing browser from Microsoft.

Analysts said the announcement is clearly timed to stem or limit further market erosion. Later this summer Microsoft is scheduled to release Windows 98, which will have the Explorer browser fully integrated with the operating software.

Cryptography: The Art & Politics-2

In this second article, the author concludes his discussion of cryptography with a look at the *politics* of this topical but thorny subject. The benefits of secure cryptography are great for ordinary citizens and companies, ensuring the privacy of their communications and the security of their electronic financial transactions — but governments and their law enforcement agencies aren't too keen, because they can't keep a quiet eye on everything...

by Dr Glenn Pure

Cryptography, and the desire of governments to control its use, is looming as a very important public issue. However, that doesn't mean it's going to attract wide attention. In fact the issue could be a bit of a 'fizzer' in terms of public profile. After all, very few people are conscious users of this technology at present — even though, as already noted, cryptography is already in widespread use.

A potential lack of public scrutiny by itself isn't a major problem, but combine this with a lack of technical understanding on the part of politicians and many bureaucrats, and that makes a good recipe for poor decisions.

Restrictions on cryptography have existed for a long time in many countries, including Australia. But they have drawn little attention, because they have been largely targeted at the export of this technology. Export controls have existed under international agreements, primarily aimed at limiting access by terrorist regimes to weapons or other 'military' technology.

A few firms in Australia are now producing very powerful cryptographic products — and a few have already run foul of our export restrictions. One example is the small firm Nexus, which was unable to fill a $100,000 export contract because of the restrictions. Surprisingly, Nexus was only trying to export a product with a 48-bit key — which isn't considered very secure.

In the US, export controls on 'crypto' have received a lot of media attention. The US software industry is BIG, and the increasing need for strong cryptography in many software products is putting a serious dent in the export orders of some major firms. The US industry is especially annoyed because the same cryptography algorithms they want to export in their products are freely available in many overseas countries and can even be imported back into the US.

For example, DES is a published standard and is widely available in many parts of the world, including Australia; but until recently it was effectively the subject of a total US export ban. In the case of RSA, this is protected by a patent but apparently only in the US. RSA encryption is available in other countries, in non-US products.

The US export controls have attracted a lot of international attention as well, largely because of the market leadership of many US software products. One good example is Web browsers, where Netscape and Microsoft between them have a large portion of the global market. Their browsers have inbuilt encryption capability using both public key and secret key algorithms. But this capability has to be seriously 'nobbled' before the products can be exported from the US.

So if you want to use these browsers for a bit of electronic shopping on the Web, beware! They only provide effective secret key lengths of 40 bits in length — potentially breakable in an hour or two, maybe less.

As already hinted, the export controls simply aren't effective, but not because anyone is breaking the law. It is easy for anyone, including the 'bad guys', to legally obtain products containing strong encryption. Don't forget that this is all simple software that will run on an ordinary PC. A lot of it can be downloaded from lots of different Web sites and bulletin boards in many countries.

Another interesting feature of the US

The DES challenge

Tens of thousands of computers across the US and Canada, linked together since January 1997 via the Internet in an unprecedented cooperative supercomputing effort, have decoded a message encrypted with the Data Encryption Standard (DES) algorithm. Success was achieved on 18 June by a syndicate known as DESChall.

Rocke Verser, a contract programmer and consultant who developed the necessary software in his spare time, said "Tens of thousands of computers worked cooperatively on the challenge, in what is believed to be one of the largest supercomputing efforts ever undertaken outside of government". Using a technique called 'brute-force', computers participating in the challenge simply began trying every possible decryption key — all 72,057,594,037,927,936 of them!

At the time the winning key was reported to RSADSI, the DESchall effort had searched almost 25% of the total key space. At the peak of testing, over seven billion keys were being tried per second.

This is the first public report of DES being broken. The computing effort involved nothing more than 'spare' CPU time, mostly on ordinary PCs, by thousands of users who have never even met each other.

More information is available at **http://www.frii.com/~rcv/deschall.htm**

export controls is that they affect software and 'hardware', but not published material. In fact, it is fine to print the source code on paper, send it overseas, scan this into a computer and compile it.

This is exactly how the very well known freeware encryption package Pretty Good Privacy (PGP) was 'exported' from the US. The author of the software, Phil Zimmerman, was subjected to years of litigation by the US government for doing this, but was recently cleared. Version 5 of PGP has recently been 'exported' from the US in hard copy form and has now been scanned and compiled. It is available at the following web site: **http://www.ifi.uio.no/pgp**

While the US export debate has been the main focus of attention until now, a much bigger issue is now dominating attention, namely domestic controls on use of encryption. Outside the US, some countries have already acted. For example, France has banned the use of strong cryptography for some time now, even when there is a compelling business reason such as in banking security.

The US and other countries aren't planning outright bans, but will take a more subtle approach. In June this year the US gvernment introduced the Secure Public Networks Act, which seeks to enforce a domestic system of key recovery which enables government officials to obtain encryption keys. According to the US Centre for Democracy and Technology 'the bill would also codify into law the current 56-bit limit on encryption exports and create 15 new crimes relating to encryption'. At the time of writing, this bill was still to be debated or passed.

In Britain, a similar move is in planning. The UK government released a discussion paper in early 1997 proposing an even more stringent key recovery system than that in the US. Both the US and UK proposals have been widely criticised, especially by civil liberties and human rights groups.

No one really knows what the Australian government is thinking on this issue, because it hasn't made any announcements — although it is tipped to release a position paper, probably by the time this article goes to press.

The Australian government did commission a discussion paper on how it should manage the cryptography issue. They chose a former Australian Security Intelligence Agency (ASIO) deputy head, Mr Gerard Walsh to prepare this and his report, known as the Walsh report, was scheduled for release in early 1997. However, the government changed its mind about releasing the report at the last minute.

Some suspected Mr Walsh was chosen because he would produce a report which argued for strict controls on cryptography — a position that would probably be sympathetic to his former colleagues in the intelligence community. No one really knew, and it looked like we would all be left pondering.

Even an attempt to obtain a copy of the report under 'freedom of information' failed. But Electronic Frontiers Australia, which lodged the initial FOI request, finally succeeded after an appeal. They obtained a largely complete copy of the report with only a few small sections censored. The report, in fact, argues against restrictions on the use of cryptography. In commenting on his report after the successful FOI request, Mr Walsh was quoted as saying the government should abandon attempts to control encryption as 'doomed to failure' and 'an exercise in futility', because criminals and terrorists would easily bypass any controls.

Coming back to the US and UK governments, neither say they actually intend to ban the use of cryptography. Instead, they both target the certification authorities (CAs), which act as secure public directories where anyone can obtain a certified copy of anyone else's public cryptography key. Under the proposed restrictions, CAs will be obliged to store users' private encryption keys as well as their public keys. The private keys would be inaccessible to normal CA users, but would be made available to authorised government officials on demand. Interestingly, in the proposed US law such a key access wouldn't require a court order.

CAs don't have any inherent need to store private keys. In fact the simple act of a key owner (like you or me) revealing a private key to another party like a CA destroys the main value of key — its ability to provide user authentication. If another party has access to your private key, it is impossible to guarantee that any signature generated with that key was done by you. Even though CAs are meant to be very secure and trustworthy, they will be staffed by human beings. It's easy to imagine lots of situations where an employee of a CA decides to pinch a few keys to make a bit of money on the side, or get some revenge on their employer for something that might have upset them.

Who will be legally liable if a private key is compromised? Well, the courts will have to establish who compromised the key — was it the key owner or the CA? In many cases, it will be just about

(Continued on page 93)

Phil Zimmerman and PGP

Phil Zimmerman, author of the PGP (Pretty Good Privacy) freeware encryption package. (Courtesy PGP)

PGP is an internationally-acclaimed freeware encryption software package that was first released in 1991 and is now virtually a standard for encryption of e-mail. It contains both RSA public key encryption and secret key encryption algorithms. The secret key algorithm uses very strong 128-bit keys.

PGP can perform a full range of encryption functions, including digital signatures and message encryption for privacy. Ordinary computer files, email, or anything else for that matter, can be encrypted. PGP will run on a number of platforms, including standard DOS-based personal computers.

Phil Zimmerman, the author of PGP is very well known among those who follow cryptography. More importantly, he has a very strong following in many less fortunate countries like Burma, or some former 'iron curtain' countries with poor human rights records. People opposed to the regimes in these countries use PGP to protect information that might land them in trouble because of their human rights campaigning. Quite a few have been jailed — and probably worse — for using PGP.

You can find out more about Phil Zimmerman and PGP at **http://www.pgp.com/**.

New graphing software for the Pocket Sampler

If you have a Pocket Sampler and use it to log data, you've probably struck a major limitation in the original Pocket software — you can't display a stored waveform, and have to rely instead on importing the data into a spreadsheet to see the results. Software writer Cyril Martin has addressed this problem and has come up with a handy Pocket file viewer, which he is releasing as shareware...

by Graham Cattley

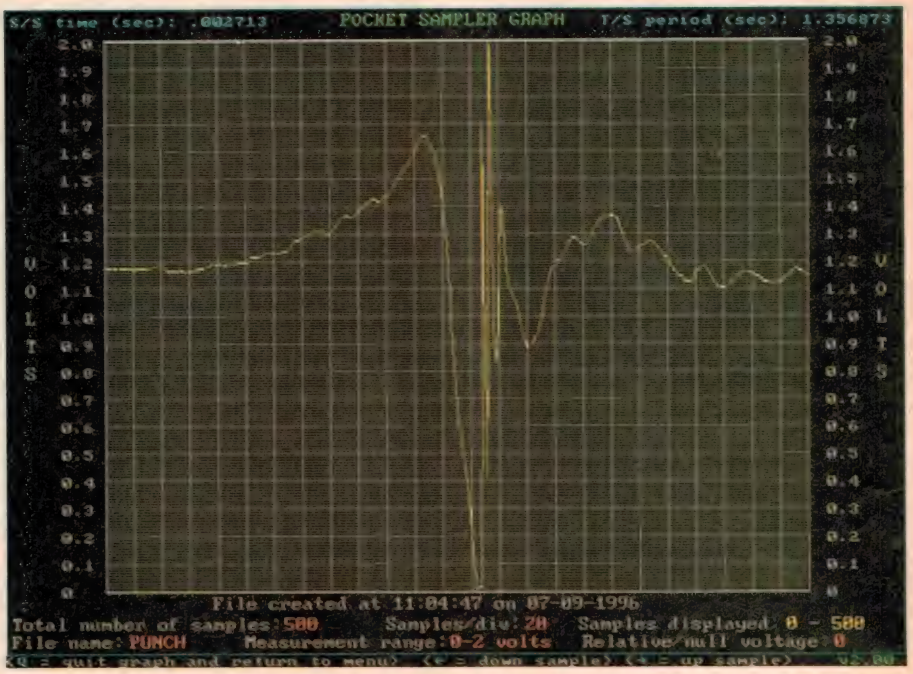
Back in the August 1996 issue I presented the Pocket Sampler — a small, self powered data logger that connected to a PC's parallel port. I also wrote a fairly comprehensive piece of software to go with it, that would allow you to log data over a period ranging from milliseconds to months. Unfortunately, due to time limitations I couldn't include all the features that I would have liked and so POCKET.EXE went out into the world with a few limitations.

The most obvious of these was the fact that you couldn't load in a saved XXX.PKT data file to view the results of the sampling. The only real way to make any sense of the saved data was to load the file into a spreadsheet and graph it from there. This would almost certainly (these days) involve loading Windows and then the spreadsheet, and even if you then had a macro to automatically load and display the data, the whole procedure was complicated and time consuming.

Graphing software

Software writer Cyril Martin has come to the fore with an answer to all the above problems. His POCKETG2 graphing software is specifically designed to display a clothesline graph directly from the XXX.PKT files generated by the Pocket Sampler software.

Cyril's reason for writing the software was mainly because the thought of having to load to a spreadsheet, and then rely on its internal graphing to do the right thing, sounded a bit hit and miss. As most of his measurements were recorded over a period of 10 to 60 minutes, a quick and simple way to view the stored data was necessary. After a couple of weeks work on the software, POCKETG2 was developed to address this problem, and he has decided to release it as shareware to help other Pocket Sampler users.



The main graphing screen of POCKETG2. All the information on the recorded data is on display along with the plot, which is scaled to fit the screen. The registered version of the software alows you to scroll up and down the waveform using the arrow keys, and you can also change the samples/div without having to reload the data.

POCKETG2.EXE is a DOS program, and it can display the data in a graph with an upper limit of 5000 samples (with the registered version).

Four preset voltage scales are available, covering 0-2 volts, 0-20 volts, 1-0-1 volts (10mV resolution), and 0.1-0-0.1 volts (1mV resolution). If a non-standard reference voltage was used in taking the readings, the user can enter its value and the software will plot the graph accordingly.

As well as voltage scales, a number of preset samples/div settings are available, in a 1/2/4/10/20 scaling.

Despite its simple interface, POCKETG2 is quite sophisticated; there isn't room here to go into details, but I'll list here a number of other features which include:

- Automatic selection of 0 - 2V or 0 - 20V scale.
- Automatic selection of FAST or TIMED mode.
- Status/help line at the bottom of each screen.
- A display of all parameters including single sample time, total sampling time, mode, number of samples recorded, voltage range, date and time of end of sampling, as well as the reference voltage if selected.

- A choice of scale resolution for a centre zero display.
- A choice of 500, 200, 100, 50, or 25 samples per screen.

As you can see, the program is quite comprehensive, and as an incentive to register, Cyril is offering the ability to view over an expanded scale to cover up to 5000 samples. (This expanded scale feature is disabled in the shareware version.)

You can download the shareware version (POCKETG2.ZIP) from the *Electronics Australia* BBS (on (02) 9353 0627), from the *EA* website (**www.electronicsaustralia.com.au**) or direct from the author.

The cost of the registered version is $10.00 (plus $5.00 packaging/postage) which gives you a version with a fully operational expanded scale feature.

Make any payments payable to: C&L Martin, and mail to: 49 Peary Street, Northgate Qld 4013. If you have any further queries you can get in touch with him on the above address, or email to **clm@ats.com.au**. Cyril's website for accessing both shareware and registered version is: **http://sunshine.net.au/pocketg/register.htm** ❖

Pocket software updated also...

A new version of the Pocket Sampler software is now available! Having said that, I think I should qualify it by saying that it is a 'no frills' version with no graphical display whatsoever. This should suit unattended or automated batch processing, as the various sampling parameters are set by editing a configuration file, although various command-line switches can also be used.

While I have been endeavouring to re-write the original POCKET.EXE program for some time now, I realised that an all-singing, all-dancing updated version simply wasn't going to happen. Instead, I've opted for a series of more specialised applications, which I feel will better suit the many Pocket Sampler users out there.

The new text-based version is called POCKETTX.EXE, and will be available from the EA BBS and website as the file POCKETTX.ZIP. Please let me know what you think, as I am now working on a simple Pocket-based oscilloscope application. (**G.C.**)

(Continued from page 91)

The RSA Public Key Cipher

Three numbers are needed for RSA to work. In addition to the public and private keys, there is also the modulus. A modulus is nothing more than a number used to divide other numbers. But the modular arithmetic at the heart of RSA is definitely a bit out of the ordinary. In this form of arithmetic, the remainder of a division operation is kept, instead of the quotient. For example, if the number 10 is divided by the modulus 3, the result would be 1 in modular arithmetic (10 divided by 3 gives a remainder of 1).

RSA processes messages after breaking them into blocks and involves very simple mathematical operations. To encrypt a message block, it is raised to the power of the public key, then the mod n value is found (n is the RSA modulus). To decrypt, the encrypted block is raised to the power of the private key, then the mod n value is found.

RSA works because the public key, the private key and the modulus share a special mathematical relationship based on some very clever number theory — but which is too complex to explain here. In mathematical jargon, the modulus is the product of two large prime numbers, which are usually referred to as p and q. The public key is the multiplicative inverse of the private key with respect to the product $(p-1)(q-1)$. And that was only the simple explanation! If you want a more thorough explanation, you can find one on my web page (see the references at the end of this article).

The security of RSA is dependent on the fact that everyone knows your modulus, but it is essentially impossible to work out the two large prime numbers (p and q) that were multiplied together to produce it. If you did know p and q, you could calculate the private key and decrypt any message.

One interesting feature of RSA is that the public key can be a small number. In fact the number '3' is commonly used and if used properly will not present any threat to the security of RSA (the message block being encrypted has to be larger than the cube root of the modulus). However, the private key must be a large, unguessable number.

impossible to be certain. Past experience suggests that more often than not, the user will be blamed.

This past experience includes the problems some people are having with huge bills being mysteriously clocked up on their digital mobile phones. Employees of the mobile phone service providers could conceivably abuse their position of trust and gain the secret access codes, but the phone companies apparently normally blame the consumer for not being careful with phone security.

The big push for key recovery systems is, nevertheless, based on a very commendable goal. Law enforcers want to stop criminal elements or terrorists taking advantage of powerful cryptographic processes to hide their activities from the law. By definition, criminals and terrorists don't respect the law, including any encryption laws that may be put in place.

The main problem, however, is that it is very easy to avoid key recovery:

Since recovery is only possible for keys lodged with CAs, just don't use CAs — instead privately exchange keys with the parties with whom you want to communicate. This obviously limits who can exchange messages.

A much more effective bypass is to use the CA and public key system, but only to authenticate the parties with whom you want to communicate. Each user generates a fresh public key pair but does not lodge this with the CA. This 'unescrowed' key pair is then used to conduct encrypted message exchanges.

Governments could try and counter both of these measures. To do so, they would need to routinely and randomly monitor all electronic communications and try and decrypt these. There ARE major privacy problems with this approach, since traffic between innocent parties is being read. Alternatively, government can legislate to ban encryption that doesn't involve the key recovery system. In reality, this would be just about impossible to police, and penalties would have to be unrealistically high to deter criminals.

It will be interesting to see how the Australian government finally handles this one.

If you're interested in finding out more on cryptography, there are some excellent books as well as plenty of good material on the Web. A classic book is Bruce Schneier's *Applied Cryptography* (2nd edition, Wiley 1996), which also contains source code in C for many ciphers. On the web, you will find more background news and some links to major sites on my web page at **http://www.pcug.org.au/~glennpur/**. Alternatively, a good starter is the RSADSI Web page at **http://www.rsa.com**. ❖

Computer

News & New Products

HP CDR/CD-RW Writer enhanced

Hewlett-Packard has released the HP SureStore CD-Writer Plus 7200, the second CD-ReWritable (CD-RW) offering from the company. The SureStore CD-Writer Plus 7200 comes bundled with seven industry-leading software applications from pre-eminent manufacturers including Adaptec, Adobe, Corel, DocuMagix, HP and Norton, making the drive seven times more powerful.

Available in both internal and external versions, the SureStore CD-Writer Plus 7200 drive is a 3-in-1 drive, functioning as a CD-ROM, CD-Recordable and CD-ReWritable drive. It is as easy to use as a floppy, yet it provides users up to 650MB of removable data-storage capacity — the equivalent of more than 400 standard high-density floppy disks — while retaining compatibility with industry-standard CD formats.

The drive reads data at a 6x transfer speed and writes at a 2x transfer speed — on both CD-RW and CD-Recordable (CD-R) media. The internal version has an IDE interface and installs without an adapter card; it simply plugs into a PC's standard hard-drive cable. The external version plugs into a PC's standard parallel port, and has a pass-through connector that allows both drive and printer to be attached to the PC.

Bundled with the HP SureStore CD-Writer Plus 7200 is Symantec's Norton Antivirus; Adobe PhotoDeluxe; Digital Now's Photo Organizer; Corel Print House Magic; and DocuMagix PaperMaster Live. Also provided are four CD creation packages from Adaptec: Easy CD Audio, which lets users commit their family and personal audio memories to CD; Easy CD Creator Standard Edition, which allows users to master standard CDs that can be played on most PCs; Direct CD, which lets users drag and drop files to CD from Microsoft Windows Explorer or save directly from any application; and Adaptec's Jewel Case and Disk Labelling software, which allows users to create jewel-case inserts and labels.

The drive also comes with HP SimpleTrax, which automatically saves files to CD, ensuring that they are protected, secure, and easy to find and retrieve — even if the CD is not in the drive.

The HP SureStore CD-Writer Plus 7200i (internal) and 7200e (external) drives have an estimated street price including sales tax of $849 and $1049 respectively.

For more information circle **160** on the reader service card or contact HP Australia's Customer Information Centre on 131347 (no STD area code required).

Firewire card links DV camcorders to PCs

Pinnacle Systems Inc., one of the world's largest suppliers of digital video capture products, has released the much awaited miroVIDEO DV300 — which permits a direct, high-speed digital Firewire connection (IEEE 1394) between the new digital camcorders and desktop PC's. The DV300 is claimed to be one of the first cards to provide video and multimedia producers with the ability to download digital video to their computer's hard disk, edit it and up load their edited video back to digital video tape without generation loss. The entire editing process is kept completely digital.

A 32-bit plug and play bus master PCI board, it offers both internal as well as external input and output Firewire connections, and includes a state-of-the-art software CODEC licensed from Sony.

'MiroVideo DVTools', the dedicated software written by Miro that is included with the card, automatically controls the transport controls of the connected DV camcorder and offers frame-accurate DV camera control, uncompromising video image capture quality, and the ability to intelligently search digital videotapes.

The miroVIDEO DV300 is currently compatible with all Sony DV camcorders and is being tested with camcorders from other manufacturers. In addition, it requires the following desktop computer equipment: 100MHz or faster Pentium compatible processor; 1 x 32 bit PCI 2.0 slot with bus mastering; 16MB RAM; 50MB hard disk space; 2GB video AV disk; 16-bit graphics board; CD-ROM drive; Windows 95 or NT.

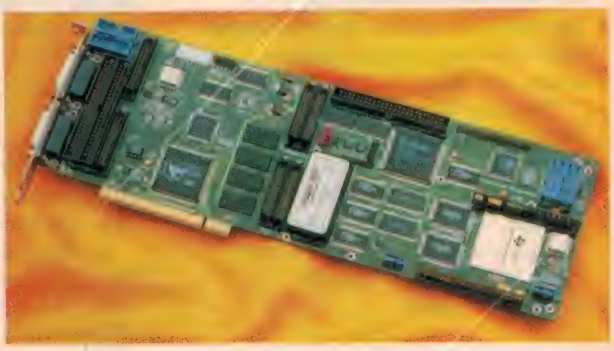
For more information circle **161** on the reader service card or contact distributor Lako Vision, 2/3 Wellington Street, Kew 3101.

Versatile data acquisition card

Innovative Integration Inc. has introduced the M62, an intelligent I/O solution featuring a 1600MIPS DSP coprocessor for control, data acquisition and communications applications.

The 132Mb/s PCI bus-based board features dual I/O sites and TMS320C620I fixed point DSP from Texas Instruments. The 'C6201 is the data collection and processing engine for the M62 and provides high-speed CPU or DMA data transfers via dedicated 100MB/s communication ports or the PCI bus. The architecture of the M62 is said to be ideal for the most demanding real-time data acquisition control, telephony, audio and motion control applications.

Dual plug-in sites may be populated with a variety of M44BUS compatible analog and



digital I/O modules. These interchangeable modules provide user configurable I/O, ideally suited for a particular application. Both I/O sites feature a high-resolution (0.01) programmable timebase capable of sampling at virtually any desired frequency in lieu of an external trigger source.

A complete suite of development tools are available for the M62. The development package includes the TI C compiler, Innovative's Zuma Toolset complete with peripheral libraries, applets, example programs in source form and device drivers. The package also includes the Code Hammer JTAG hardware assisted debuggers for code writing, debugging, profiling and analysis. The production runs under Windows 95 or NT.

For more information circle **162** on the reader service card or contact Scientific Devices Australia, 118 Atkinson Street, Oakleigh 3166.

Power supply has built-in UPS

Microgram Computers has released a combined unit housing both an uninterruptible power supply (UPS) and a PC power supply. The UPS is built into a standard PC power supply case, while the batteries and front panel occupy a 5.25" drive bay.

The UPS is rated at 500VA. Apart from power failure, the UPS also protects against over-voltage, under voltage, overload and DC short circuits. Optional software provides for automatic shutdown. The unit is available in two sizes — PS/2 or ATX.

The combined UPS/Power Supply is priced at $429 including tax for the PS/2 size and $439 for the ATX size.

For more information circle **164** on the reader service card or contact Microgram Computers, Unit 1, 14 Bon-Mace Close, Berkeley Vale 2261.

Windows software for real-time SPC

Fischertechnik has developed a new language for SPC (stored-program control) of machines, using flowcharts to describe the sequence of logic functions. The language has been developed for use with the company's computer interface units and model construction system.

The fischertechnik software, called LLWIN, is said to be ideal for 'real-time' machine control. The language runs under Windows 3.1 or 95 and provides a graphical depiction of the flowchart including: decision blocks for switch inputs, action blocks to control each output and other blocks to increment and test up to 99 variables. Other features include a terminal block to aid testing and debugging, time delay blocks, one-shot blocks, subprogram blocks and improved aids such as automatic routing and the ability to add comments and graphics to the program page.

LLWIN provides real-time control under Windows. It achieves this using a programming system called iCon-L, which is used in industrial automation and which permits real-time operation.

Two versions of LLWIN are currently available. Version 2.04E controls only the 30566 interface and costs $99. Version 2.10E controls both the 30566 and 30402 interfaces, comes on CD-ROM with additional instructional information and costs $199. The minimum computer requirements are 486/66 DX2, 8M RAM. The 30566 interface costs; $144.80 ex-tax and the 30402 interface; $351 ex-tax.

For more information circle **166** on the reader service card or contact Procon Technology, PO Box 655, Mount Waverley 3149.

PC-Check updated

A new version of leading PC diagnostic package PC-Check has just been released. Version 3.5 is a fast, accurate and easy-to-use diagnostic tool that enables the user to completely check the configuration and reliable operation of IBM-compatible PC's.

The new version includes several important features, including the ability to detect fake cache and over-clocked processors. Version 3.5 also detects the FDIV Pentium bug on 60MHz and early 90MHz processors, and the FIST bug in Pentium Pro and Pentium II processors.

Another relevant feature included is a Year 2000 compliance test, which reports the degree of hardware changeover support the machine offers for the year 2000. This is an ideal way for both end users and assemblers alike to ensure that new equipment is compliant and to find any non-compliant computers before the date rolls around. A product called Fix2000 (sold separately) is also available to help rectify existing compliancy problems.

PC-Check Self Boot is ideal for PC manufacturers, OEM's, resellers and VAR's as well as help desks and in-house troubleshooters. The RRP is $475 and upgrades from previous versions are $130.

For more information cicle **167** on the reader service card or contact Tech Star Distribution, Unit 2, 31 Black Street, Paddington 4064.

RAID subsystem

RAID (Redundant Array of Inexpensive Disks) is the key to today's most demanding storage requirements: great reliability, large capacity and high performance. Since RAID technology has developed and become more affordable than ever, a huge demand for RAID subsystems can be expected in a wide variety of applications, especially in telecommunications, networking and computer telephony.

The RAID-8001 is a SCSI-to-IDE RMD subsystem supporting RAID levels O, 1, 0+1, 3 and 5. Up to six 3.5" IDE/E-IDE HDDs, supporting mode O, 1, 2, 3 and 4, can be installed into the RAID-8001. When it is configured as RAID level 3 or 5, the maximum storage capacity is 45GB, if six 9GB EIDE HDDs are used. With Raid 0 the maximum capacity is 54GB.

The RAID-8001 allows one HDD failure with no impact on existing data. A specially designed cartridge is used to hold each HDD and to support online hot-swap replacement. Data is re-built automatically if new HDD is plugged into the RAID8001. To increase reliability the RAID-8001 is equipped with two 300W hot-swap redundant power supplies. The power supplies can be configured for 90-132 or 180-264V AC @47-63Hz line frequency.

For more information circle **169** on the reader service card or contact Priority Electronics, 189 Bay Road, Sandringham 3191. ❖

Webwatch

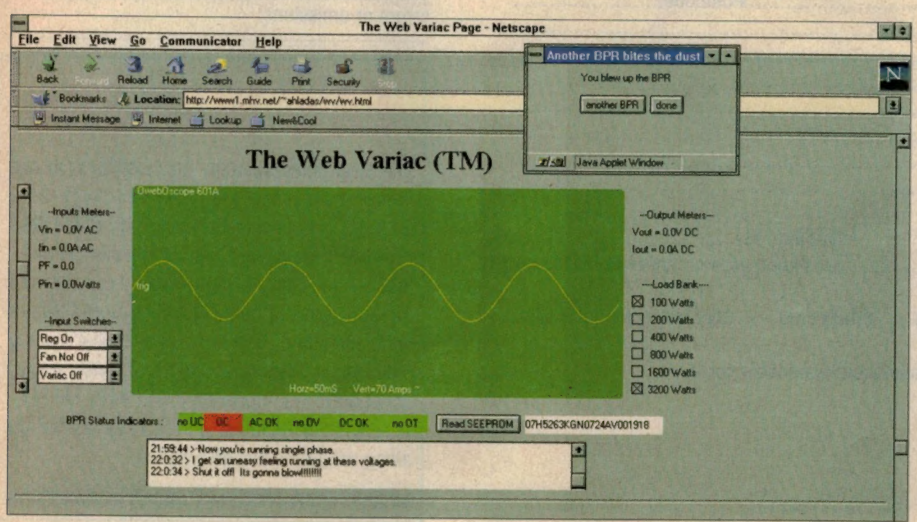
by Graham Cattley

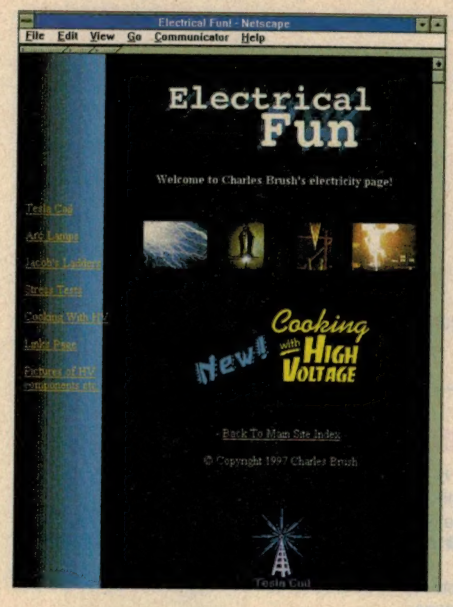
I COULD SAY that you should make tracks to the Protel site, but I won't. Instead I suggest that you go to **http://www.protel.com**, and have a look around. They tend to go in for large graphics and a rather disconcerting use of frameless frames, but once you're in there's quite a lot on offer.

Protel are world famous for their PCB design software, a version of which we use here at *EA*, and you can download a freeware version of it, along with several printing and output utilities as well. If your system's up to it, get the trial version of the new Protel98 EDA design suite, and then have a browse through their knowledge base to answer any questions you may have.

4QD HAILS from Cambridgeshire and they design and manufacture speed controllers for battery powered electric motors. Their site is packed with info on motor control, DC power control, electric vehicles and go-karts, plus useful stuff for all you robotics people out there. There's also a hundred or so circuits, in clear bitmap form each with their own description and explanation. All up, a clear, friendly honest site with lots to offer — go to **http://www.argonet.co.uk/users/4qd/** and see what I mean.

I'M NOT SURE what to make of **http://www1.mhv.net/~ahladas/NewPWeb.html**, but their first and only Variac on the web is great fun. I'm not going to say much more about the site except that you'll need a fairly up to date browser to drive their TALLCOW MOO software. Oh, and try not to blow up too many BPRs...

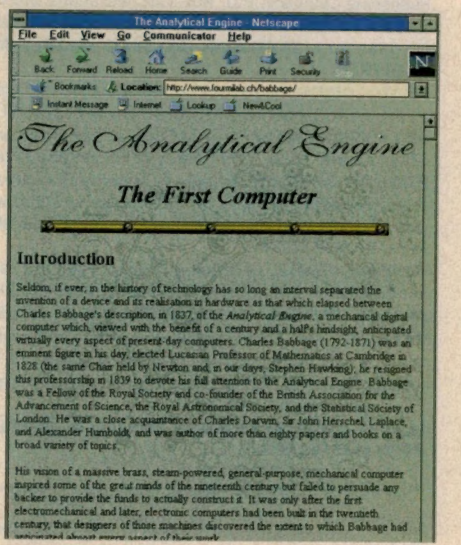




SPEAKING OF blowing up, check out **http://www.foundrygroup.com/cbrush/fun/** where Charles Brush has lots of info on Tesla coils, Jacob's ladders, arc lamps and any other high voltage frivolity you can think of (including HV cooking). It's good fun as well.

QUESTLINK, at **http://www.questlink.com/** have what they call an 'absolutely awesome' index of integrated circuits, semiconductors, components and EDA tools, and I for one agree wholeheartedly. You'll have to register with them to download detailed specs on any of their 350,000 products, but this is relatively painless and well worth it. Registered members can access datasheets, application notes, technical manuals and FAQs in PDF format, and you have the option to order parts online as well.

BY NOW YOU are sure to have come across references to the new 4mm square MicroDisplay — it's the size of a lentil, and can display images in full colour at 640 x 480 pixel resolution. At the APRA web site **http://www.ai.mit.edu/people/alvelda/microdisplay.html** you'll find some pretty pictures of this wonder of miniaturisation, along with a rather technical description of the technology behind it. Most of the images are rather huge, (ironic, isn't it?) and there's not much more on the site, but it's worth a look.



BACK IN 1837, Charles Babbage described his Analytical Engine, a steam powered computing machine so far ahead of its time that it couldn't be built with the technology available. Working from his plans, it was eventually built in 1991, and it currently resides in the Science Museum in London.

If you head over to **http://www.fourmilab.ch/babbage/contents.html**, you can try programming a virtual Analytical Engine, which runs as a Java applet in your browser. Be warned, it's not as easy as you may think, but if you are in to programming take the challenge and have a go. This site is one of many, many interesting links from John Walker's Index Librorum Liberorum, listing the contents of **http://www.fourmilab.ch/** which could fill an entire Webwatch column in itself. ❖

EA Directory of Suppliers

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
Altronics	WA	•	•	•	•	•	•	•
Dick Smith Electronics	ALL	•	•	•	•	•	•	•
Emona Instruments	NSW						•	
Jaycar Electronics	Eastern	•	•	•	•	•	•	•
Oatley Electronics	Eastern	•			•	•		
Obiat	NSW						•	
RCS Radio	NSW			•				
Scientific Devices	VIC						•	

KEY TO CODING

A	Kits and modules	D	Components
B	Tools	E	IC chips and semiconductors
C	PC boards and supplies	F	Test and measuring instruments
		G	Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Company, P.O. Box 199, Alexandria 2015; phone (02) 9353 9992.

BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**

PHOTOCOPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

READER SERVICES BULLETIN BOARD: (02) 9353 0627; ANSI, 24 hour access; any rate to 28.8kb/s.

PAYMENT: Must be negotiable in Australia and payable to Electronics Australia. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria NSW 2015; phone (02) 9353 0620.

PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

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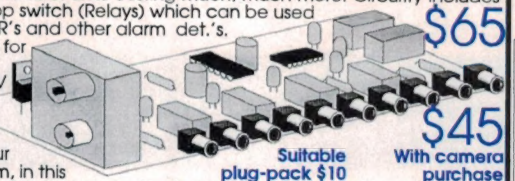
EA's Web Site

The Electronics Australia World Wide Web site is now operational, in a preliminary form. On it you can access and download all of the files available on our very popular Reader Services BBS — including project index files, software for our projects, notes & errata, useful shareware and so on. You can also see what's in the latest issue, and even take out or renew a subscription to the magazine if you wish. We'll be adding extra features and services as we go along, so please pay us a visit at:

http://www.electronicsaustralia.com.au

KIT OF THE MONTH

PROFESSIONAL QUALITY 2/3/4 ch. (selectable) SEQUENTIAL A/V SWITCHER: Yes you can have up to 4 cameras and up to 4 microphone inputs! Uses relay switches to produce much better bandwidth / picture quality than is possible with C²MOS IC's. Has many more features and is of better quality than many commercial units costing much, much more. Circuitry includes a VCR Rec. / Stop switch (Relays) which can be used with standard PIR's and other alarm det.'s. Has A/V outputs for a monitor, optional UHF A/V mixer amp, can be inc: Add a security channel into your existing TV system, in this case use your TV set as the monitor! Mixer/Amp even includes a switchable test pattern generator for easy tuning. Low cost, PCB and all onboard components kit!:(K118) $65...$18 Extra for the UHF mixer/amp..



$65

$45

Suitable plug-pack $10

With camera purchase

MAY-JUNE REDUCED-CLEARANCE ITEMS

BRASS SPY HOLES Quality made spy holes for doors etc. Easy to fit, just drill a single hole. Will fit door / panel thickness from 33 to 52mm.

$5

UNIVERSAL SWIVEL BRACKET Very strong!! Heavy duty! Will rotate 360deg. & tilt 180deg: 10 for $15

FIBER OPTIC CABLE (COMS GRADE) approx. 0.6mm diam. $1 per Mtr.

WIRED IR EXTENDER KIT $18

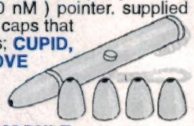
GEIGER COUNTER KIT + TUBE!!! $40

60 SECOND SOUND RECORDER. IC, Contains all the control circuitry, AGC, power amplifier, A-D/D-A converters and even a 256K Flash EPROM: Complete good quality 60 Sec. digital rec. IC that even has random / sequential access of fixed/ variable length messages. Only requires a few passive components, an electret mic. & a spkr. Special introductory price: $23

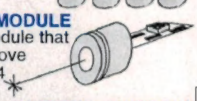
OVER-SPEED MONITOR KIT Kit inc. PCB + HALL SENSOR +BUZZER $22

OPTICAL TACHOMETER KIT Measures RPM of prop. shafts etc. without physical contact. similar to the kit published in SC. (May 1988), but includes X-tal control calibrator. Use a DMM on 200mV or a 3 1/2 digit panel meter as the display PCB + all on-board components:(K117) $25.

LASER DIODE POINTER (Key-chain) Very bright (650 nM) pointer. supplied with 4 extra lens caps that produce symbols: **CUPID, I LOVE YOU, LOVE HEARTS & A LADY.** $29



LASER DIODE MODULE Same quality module that is used in the above laser pointer: $24

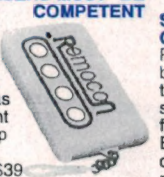


12V/7Ah GEL BATTERY BARGAIN Fresh stock NEW standard battery plus **1 NEW INTELLIGENT GEL / LEAD-ACID BATTERY CHARGER** for: $30

***** SPECIAL *****

GRAB THEM BEFORE THEY GO!!! STILL THE BEST LASER LIGHT FOR HOLIGRAPHY ETC. HELIUM - NEON LASER TUBE & POTTED SUPPLY: Large 2-3mW laser head + compact potted US made power supply. Head plugs into the supply & connects to 240Vac.. Bargain: $65 **WARNING!!! VERY BRIGHT NOT FOR USE BY CHILDREN!!! ALL LASERS MUST BE USED UNDER COMPETENT SUPERVISION.**

NEW ! 4Ch. UHF LEARNING REMOTE Can be programmed as a spare for your current remote or to replace up to 4 other units and combine into 1:(TX1) $39



*****SPECIAL***SPECIAL***SPECIAL*****

FOR $1 EXTRA WITH EACH ORDER WE WILL SEND YOU A WIRING KIT !!! Also great for car installations, car radios mobile phones, fog lights etc. **Contains the following:** 4 different colours, 2 different guages of wire, Spade connectors, Spade type fuse holders, Spade type fuses. More than 17 mtrs. of wire. Approx. 0.2 Kg. **Limited offer!!! just $1**

$1

***** UNBELIEVABLE BARGAIN *****

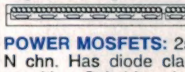
2 METER SATELLITE DISH + STAND This not a cheap lightweight domestic dish, this is serious telecomunications standard equipment. It's made from galvanised steel and the stand alone would take two strong people to lift, This dish needs to be transported by truck. So ring for details and to arrange transport or pickup. There is no LNA but has 3W transceiver + all fittings. Normally thousands of dollars but for this month around $260.

$260

DRAWING IS NOT ACCURATE

***** SPECIAL *****

BRAKE LIGHT INDICATOR-60 LED KIT This kit has two PCB's + current limit resistors + 60 LED's to make a very bright brake light etc. 600mm long: $15

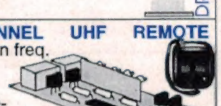


POWER MOSFETS: 2sk 2175 15A-60V N chn. Has diode clamp ie. not static sensitive. Suitable substitute for devices like BUZ71A or MTP3055E: 10 FOR $10

8 CHANNEL IR REMOTE CONTROL This kit converts a Magnavox IR remote into an IR remote using an SM5021 encoder IC. We use the case & 8 keys, and replace the PCB. The RX uses an IR receiver module on 38KHz. There are 8 outputs. 2 of outputs toggle & 6 momentary outputs. To convert the TTL outputs to drive a relay, use our (K) Dual Relay Kit. Tx PCB: 89 x 30mm. Rx PCB: 48 x 34mm: * TX Kit: (K65T) $20 * RX Kit: (K65R) $20

15mW GREEN LASER DIODE This is a very spectacular, very bright laser, May require a licence (check with your local authority). Will suit any of our laser light shows. Price on application.

TWO CHANNEL UHF REMOTE CONTROL On freq. of 304MHz, transmitter is assembled, receiver is a kit, inc. two 12V/12A relays, 1Tx + 1Rx kit:$45, additional Tx: $15



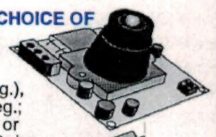
SUPER BRIGHT BLUE LEDS THE BRIGHTEST WE'VE OFFERED, Super bright at 400mCd $1.50 ea. 10 for $10...**5mm LEDS AT SUPER PRICES** 1Cd red 10 for $4,..300mCd green $1.10 ea. or 10 for $7,..3Cd red $1.10 ea. or 10 for $7,..3Cd yellow also in 3mm: 10 for $9 ; Super bright...**FLASHING LEDs:** $1.50 ea. or 10 for $10...(Make small torch! mix the red green & blue)

***** SPECIAL *****

MASTHEAD AMPLIFIER KIT Our famous MAR-6 based masthead amp. Up to 2Ghz. 2 section PCB (power supply can be indoors): Inc. Plugpack: and 2 Weatherproof boxes: (K035) $24. (MAR-6 avail. separately)

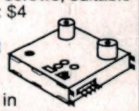
ULTRASONIC COMMUNICATOR KIT: Ref: EA Sep/Oct 93. Sounds picked up by an electret mic are modulated onto an oscillator which drives a 40KHz U/S transducer. This is received by a 40KHz U/S receiving transducer and is amplified & detected. The detected signal is amplified by a three transistor amplifier to drive a speaker. This makes a comms. link over a few metres. Ideal for experiments. Inc. PCB's all on-board parts, transducers, speaker & mic. Both tx & rx PCBs are 63 x 33mm: (K45) $18

WITH YOUR CHOICE OF ONE OF THE FOLLOWING LENS Pinhole (60deg.), 78 deg.; 92 deg.; 120 deg.; $89 or $99 with a 150 deg.

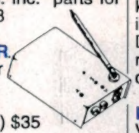


CASE AND SWIVEL A small plastic case suitable for enclosing the CCD camera, plus a very strong multi angle and position adjustable universal joint swivel bracket plus screws, suitable for stereo speakers etc.: $4

UHF A-V MODULATOR Professional stable design PLL, tunable UHF A/V modulator with built in Antenna booster and a test pattern generator: As used in VCR's. Inc. parts for a 5V regulator (RM1) $18



UHF A-V TRANSMITTER Send video to TVs in your home. Inc. Metal case telescopic antenna, RCA connectors & leads: (G01) $35



32mm AUDIO PREAMPLIFIER Small kit which inc. a microphone. Gives Line level output for use with the above Modulator or transmitter: (K105) $6

32mm AUDIO AMPLIFIER KIT: LM380 based power amplifier can directly drive a speaker from a line output from above kit: (K106) $8

TIME LAPSE RECORD INTERFACE New kit, now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control:(K48) $35

PIR MOVEMENT DETECTOR module to suit above kit, very small:(G66) $16

LED IR ILLUMINATORS KITS 10 LED:(K103) $14, 30 LED:(K102) $30

HIGH RESOLUTION MONITOR Brand new 240V 30cm enclosed computer monitor + a video conversion kit. Gives better resolution than TV's!! Avail. early Feb. Limited but good qty. **BARGAIN PRICE.**

WE have tried to keep constant prices for the last few years but unfortunately most of our prices must rise by 10 - 15% next month. Still very competitive prices!

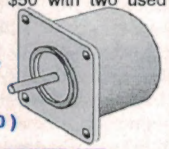
MORE KITS Too many to list here. Check out our Internet pages to see the latest and greatest kits and parts on sale.

****** TWO GREAT SPECIALS ******

*****STEPPER MOTOR DRIVER KITS*****

NEW!!! COMPUTER CONTROLLED STEPPER MOTOR KIT New improved kit that can drive larger motors and has optoisolation between the circuit and the computer. DB25 connector provided on PCB. Needs a standard DB25 cable for connection to a PC, and a power supply for the motor drive section. PCB and all on board components kit plus software and notes: $40 or $50 with two used 1.8deg. motors !!!

(ONE ONLY NEW MOTOR OF SIMILAR QUALITY TO THE ONE SUPPLIED COSTS OVER $100)

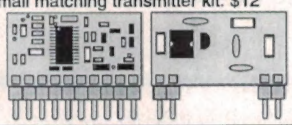


STEPPER MOTOR DRIVER KIT Kit includes a large used 1.8deg. (200 step / rev) motor & uses SAA1042A IC. **(ONE OF THESE CHIPS WOULD RETAIL FOR ALMOST $19)** Can be driven by external or an on-board clock; has a variable frequency clock generator. Ext switches (not inc) or logic levels from a computer etc set CW or CCW rotation, half or full step operation, operation enable/disable, clock speed. PCB and onboard components:$20 with 1 motor, $30 with 2 motors.

AUTOMATIC LASER LIGHT SHOW KIT The changes every 5-60 sec, adjustable. Countless displays single to multiple flowers, collapsing circles, rotating single & multi ellipses, stars, etc. PCB + all PCB components, 3 motors & mirrors :(K83) $65 With pointer kit for $79

SOLID STATE 4-6A PELTIER EFFECT COOLER / HEATER 3.3A@14V PELTIER: $27, 6A @15VPeltier: $35, both are approx. 40X40X4mm, can be temperature controlled by reducing supply voltage/current, will even work from a 1.5V battery!! We supply Peltier Effect device, data sheet, diagram & circuit for a small fridge / heater.. Other requirements; Insulated box, 2 large heatsinks, & a small aluminium block. This device is used in the common 15Lr car fridge. Peltier effect Device + (G02) 12V DC Fan:(G11)

UHF DATA TRANSMISSION Stamp sized Xtal locked 433.9MHz superhetrodyne receiver module $25 Small matching transmitter kit: $12



3 LED LOGIC PROBE KIT. **(ref SC May)** Ideal for tracing digital/logic faults & powered by the circuit under test. Inc. Only PCB, all on-board components, LEDs, LED bezzels & Oatley's special case (approx. 35x24x123): (K119) $7

$7

NIGHT VISION TUBE + SUPPLY Used 25mm fibre optic tube plus an EHT power supply kit to suit. With small side blemish. Only $50

OATLEY ELECTRONICS
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Where do you GO for the last word in security...

CMOS Camera Module

Pick up size: 1/3" CMOS image sensor, picture elements 325 (H) x 288 (V), number of pixels 100k, horizontal frequency 15,265kHz, vertical frequency 50Hz, clock frequency 13.5MHz, scanning system 2:1 interlace, min illumination 1 lux F/1.4 , 300 TV lines resolution, auto shutter function1/50, 1/60 to 1/6000 sec, S/N Ratio: 46dB (AGC off), Gamma correction: 0.45, power: 9V-12V DC 0.45 Watts, lens 3.6mm F=2.0

L 5875

NEW

$99*

Security Camera in a Smoke Alarm

CCIR , image device 1/3" interline CCD, picture element 500(H) x 582(V) 270k pixels, scanning system: 2:1 interlace, horizontal frequency 15,625 kHz, vertical frequency 50 Hz, minimum illumination: 0.1 lux with F1.2 lens, resolution 420 TV lines, signal to noise better than 46dB, video output 1.0V p-p composite video/75 Ohm, auto shutter 1/50-1/100000 sec, geometric linearity has no camera distortion, Gamma linearity is 0.45, power supply 12V DC, lens: 3.6mm/F2.0.

L 5841

$149*

Colour Camera in a PIR

Colour PCB with pickup size 1/3" CCD image sensor (inter line), picture elements 500 x 582 (270k pixel), horizontal frequency 15,625kHz, vertical frequency 50Hz, synchronisation mode internal, scanning system 2:1 interlace, min illumination 1.0 Lux F/1.2, horizontal resolution 380 TV lines, auto shutter function up to 1/10,000, S/N ratio better than 46dB, video output composite 1.0V p-p at 75 ohm, BNC. Power required 12V DC/250mA.

L 5842

NEW

$349*

Audio Video Transmitter

Transmit signals from any source (with RCA outputs) to any TV. With a range of approximately 10 metres, this transmitter comes complete with RCA cables and AC adaptor.

G 5560

$89.95

Clock-Cam Camera in a Clock

Round Citizen wall clock with built-in PCB camera. About 260mm diameter, battery supplied. Camera module specifications: horizontal resolution greater than 380 TV lines, pick-up device 1/3 inch CCD image sensor, scanning system 525 lines interlaced (EIA), 625 lines interlaced (CCIR), internal synchronisation, output signal 1 Vp-p composite video into 75 Ohms, light sensitivity 0.2 Lux @ F1.4, S/N ratio 45dB, input voltage 8 to 14V DC.

L 5840

CITIZEN™

$229*

Videoman Door Intercom System

See and speak to visitors before opening your door. When a visitor presses the "call" button a welcoming chime is triggered while a video camera transmits their image to the monitor located inside. The system also includes a two-way intercom that allows you to talk to the visitor, an infrared LED lamp which allows the system to work at night, optional door latch release facility. Easy DIY installation. Cable not supplied.

L 5803

NEW

$399

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